Arizona Department of Health Services-Lead Testing in School and Child Care Program Drinking Water Grant

Project Abstract

Lead can be found in a variety of products and materials such as pipes, paint, ceramics, and gasoline, and can be harmful when ingested or inhaled. In children, lead poisoning can cause slowed development, reading and other learning problems, behavioral problems, as well as brain, liver, and kidney damage.

The Arizona Department of Health Services (ADHS) has been and remains committed to addressing lead exposure through drinking water in child care facilities and public schools in Arizona. Arizona has undertaken statewide drinking water testing for lead in public schools in 2016 and child care facilities in 2017. ADHS will continue to address potential concerns of lead exposure through drinking water by testing drinking water fixtures in public charter schools, not previously tested, with the funding appropriated under section 1464(d) of the Safe Drinking Water Act, amended by the Water Infrastructure Improvement Act (WIIN) section 2107. ADHS will utilize the U.S. Environmental Program Agency's (EPA) 3Ts guidance as a model for this program: communication, training, testing, and taking action.

Program goals include 1) offering services to test drinking water fixtures to public charter schools serving younger children, especially those under 6 years of age, first, 2) offering services to test drinking water fixtures of all public charter schools in Arizona by the end of the project period, and 3) providing education about lead exposure and the importance of testing to all public charter schools.

The Program aims to achieve the following short-term outcomes: a) schools implement a testing program and mitigate lead exposure by utilizing the 3Ts toolkit, b) reduce children's exposure to lead in drinking water, c) improve staff and community knowledge on lead in drinking water and other environmental harms, d) improve water quality and reduce lead exposure in drinking water, and e) establish routine practices such as those outlined in the 3Ts guidance.

Lead Testing in School and Child Care Program Drinking Water Grant
Fiscal Year 2018-2019 2-Year Budget Narrative
Arizona Department of Health Services
EPA-CEP-02 - PKG00254558

Category	Subtotal	Proposed budget
A. Salaries and Wages		**$119,375**
B. Fringe Benefits		**$44,169**
C. Travel		**$0**
In-State	**$0**	
Out-of-State	**$0**	
D. Equipment		**$0**
E. Supplies		**$149,628**
F. Contractual Costs		**$214,500**
6200 - Professional & Outside Services	**$0**	
6800 - Assistance to Others	**$214,500**	
G. Construction		**$0**
H. Other		**$55,222**
Additional Project Costs	**$37,958**	
ITS Direct Charges	**$17,264**	
I. Total Direct Costs		**$582,894**
J. Indirect Costs		**$39,097**
K. Total Amount Requested		**$621,991**

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A. Salaries and Wages **Total: $119,375**

Position Title and Name	Annual Salary	FTE	Number of Months		Amount of Request
Principal Investigator, Amber Asburry	$55,000	5.00%	24		$5,500
State Lab Project Manager, Jason Mihalic	$75,000	5.00%	24		$7,500
Epidemiologist/Data Manager, Jamaica Dillard	$55,000	15.00%	24		$16,500
Public Health Scientist, Mahmoud Bidabad	$50,000	65.00%	21		$56,875
Epidemiologist/Communication Liasion, Vacant	$55,000	30.00%	24		$33,000
Total FTE/Salaries		**1.20 FTE**			**$119,375**

Justification of Positions:

Principal Investigator, Amber Asburry

Amber Asburry is the project manager for this grant proposal. Ms. Asburry received her Masters of Public Health in 2012 and has been with the Office of Environmental Health for 8 years. During this time, she oversaw the implementation of a drinking water testing program in child care facilities.

Ms. Asburry will be responsible for various managerial tasks such as developing work plans and program budgets, submitting required grants and plans to the EPA, hiring decisions, supervising staff and assigning tasks, providing assistance and guidance to staff, consulting with internal programs and external agencies, and providing risk management and public policy recommendations and decisions involving environmental health issues. Ms. Asburry will also ensure a Quality Assurance Project Plan is developed and submitted to EPA for approval prior to sampling. She will also ensure that all materials used in developing documents are appropriate and ensure that all materials distributed from the Program are appropriate, accurate, and consistent with the goals and objectives of this NOFO.

Request: $5,500

State Lab Project Manager, Jason Mihalic

Jason Mihalic is the Chemistry Office Chief at the Arizona Department of Health Services State Laboratory. Mr. Mihalic has been with ADHS since 2000. Mr. Mihalic has experience in overseeing drinking water testing for lead, including the child care drinking water testing project conducted in 2017-2018.
Mr. Mihalic will oversee the sample analysis portion of this project and ensure analysis methods are conducted appropriately, efficiently, and results are reported timely.

Request: $7,500

Epidemiologist/Data Manager, Jamaica Dillard

Jamaica Dillard will be the epidemiologist/data manager. Jamaica has a Master's degree in Public Health with a concentration in Environmental and Occupational Health with prior experience in conducting water testing for lead.
The epidemiologist will be responsible for data management of sampling results for this project, maintaining a status report of public charter schools participating in the project, sharing results with the Communication Liaison, and published on the website on a weekly basis. Ms. Dillard will be part of the team to develop the Quality Assurance Project Plan.

Request: $16,500

Public Health Scientist, Mahmoud Bidabad

The public health scientist is Mahmoud Bidabad. Mr. Bidabad has experience testing drinking water samples for lead and was part of the previous water testing program ADHS administered.
Mr. Bidabad will participate in the development of sample submission forms and protocols to align with EPA methodologies and standards. Mr. Bidabad will also conduct laboratory analyses per EPA standards.

Request: $56,875

Epidemiologist/Communication Liasion, Vacant

Nature of Services to be Rendered: The Communication Liaison will be the primary communication point of contact for the project. The Communication Liaison will be the lead on the development of the Quality Assurance Project Plan development. Additional tasks will include providing training on lead exposure, technical assistance to county health departments, result notification to public charter schools, answering questions regarding results, and grant reporting. The Communication Liaison will also assist the epidemiologist/data manager on the development of a final project report and ensure project website is up to date.

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	Request:	$0

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B. Fringe Benefits — Total: $44,169

37.00%	of Total Salaries. Does not include contracted staff.				
Position Title and Name	Requested Salary		Fringe Rate		Request
Principal Investigator, Amber Asburry	$5,500		37.00%		$2,035
State Lab Project Manager, Jason Mihalic	$7,500		37.00%		$2,775
Epidemiologist/Data Manager, Jamaica Dillard	$16,500		37.00%		$6,105
Public Health Scientist, Mahmoud Bidabad	$56,875		37.00%		$21,044
Epidemiologist/Communication Liasion, Vacant	$33,000		37.00%		$12,210
				Total:	**$44,169**

C. Travel	**Total:**	**$0**

D. Equipment	**Total:**	**$0**

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E. Supplies — Total: $149,628

Item Requested	Unit Cost		Quantity (ea.)		Request
Office Supplies-Administration	$ 22.00	x	24		$528
Analysis and sample supply cost (estimate per sample)	$ 6.00	x	13000		$78,000
Lead exposure and project communication materials	$ 0.60	x	118500		$71,100
				Total:	**$149,628**

Justification of Supplies:

ADHS is requesting $22 per month to cover administrative supply cost for a total of $528 over the project period. There are an estimated 650 public charter schools in Arizona. Staff will test up to 10 drinking water fixtures per school. 2 samples will be collected at each fixture per the 3Ts guidance. ADHS is requesting $6 for supply and analysis costs per sample. The cost incorporates cost of certified metals free water bottles, analysis and laboratory supply costs. The estimated number of samples to be analyzed is 20 samples per school x 650 public charter schools = 13,000 samples. The total estimated cost to analyze the samples is $78,000. ADHS is also requesting $71,100 to cover the cost of communication materials for the project. Each school will be given a set of 180 flyers (English and Spanish flyer on lead exposure, and a program flyer) to be shared with school staff and parents. ADHS estimates the cost for the design and printing of the materials is $0.60 per flyer for a total of 118,500 flyers to be $71,100. Some flyers will be distributed to partners for notification of the project.

F. Contractual Costs	**Total:**	**$214,500**

Consultant (P&O) Costs	
	$0
Consultant (Professional & Outside Services) Total:	**$0**

Contractual (Assistance to Others)	
15 County health departments **Organizational Affiliation:** Intergovernmental agreements **Nature of Services to be Rendered:** Contracted services to coordinate and collect drinking water samples from public charter schools across the state. **Relevance of Service to the Project:** This services is the main goal of this grant, which is to test drinking water samples in public charter schools. **No. Days of Consultation:** 1.5 years, 548 days (estimating up to 6 months to execute the agreement) **Expected Rate of Compensation:** $330 average reimbursement per school sampling event. ADHS is requesting $213,200 to cover the cost of sampling all 650 public charter schools in Arizona. The $330 reimbursement rate per faciliy was estimated as 2 staff x 6 hours (scheduling/sampling/travel) x $26 per hour + $18 travel reimbursement. The $18 travel reimbursement rate is the state maximum allowable rate of 44.5 cents per mile. The median distance from county health departments to schools is estimated at 40 miles round trip (.445 x 40 miles = $17.80). County health departments will be reimbursed on actual expenses. **Method of Accountability:** County health departments will submit quarterly contractor expenditure reports (CERs) with appropriate travel receipts and sample collection logs. County health departments will work clolsely with the Communication Liaison regarding scheduling and result notificaiton for water testing with public charter schools. CERs will be reviewed and processed by the Principal Investigator.	$214,500
	$0
Contractual (Assistance to Others) Total:	**$214,500**

G. Construction	**Total:**	**$0**

H. Other — $55,222

Item Requested	Unit Cost		Quantity (ea.)		Request
Laboratory results mailed to schools	$ 1.55	x	650		$1,008
Ship sampling supplies to county health departments	$ 65.00	x	30		$1,950
Courier service for laboratory samples	$ 25.00	x	1,350		$33,750
AFIS charges					$450
iCloud charges					$800
				Total	$37,958

Justification of Additional Charges:

$1,950 is requested to mail sampling supplies to county health departments (one shipment per year), and $1,008 for mailing laboratory test results to schools. The estimated cost of shipping the supplies to county health departments is $65; estimated cost of the result packet is $1.55 x 650 schools. Courier service is also requested to deliver water samples to the laboratory from county health departments. The estimated cost is $25.00 per delivery for 1,350 (15 counties x 90 pickups/ 2 years). The total requested cost is $33,750. Additional administrative charges are requested for AFIS (procurement system) and iCloud (agency electronic storage). AFIS charges are estimated at $450 and $800 for iCloud charges.

Additional Charges Total: $37,958

ITS Direct Costs

Service Unit	**Indirect Rate**		Base		
EDC	3.56290%		$365,686		$13,029
STATE LAB	2.11824%		$199,944		$4,235

Applied against Salaries, Fringe, Travel, Supplies, Non-Capital Equipment, and P&O.

IT Charges Total: $17,264

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I. Total Direct Costs	**$582,894**
J. Indirect Rate and Costs	**$39,097**

Indirect Costs

Service Unit	Indirect Rate		Base		
EDC	19.70000%		$75,350		$14,844
State Lab	27.50000%		$88,194		$24,253

Applied against Salaries and Fringe Benefits

IT Charges Total: $39,097

NOTE: The total administrative costs for the program is $24,441. This includes salary and fringe for the administrative positions, Prinicipal Investigator and State Lab Project Manager, (17,810), $1,778 supply cost (administrative office supplies, AFIX charges, iCloud charges), $543 ITS direct charges, and $4,310 for indirect charges. The Epidemiologist/Data Manager, Epidemiologist/Communication Liaison, and the Laboratory Analyst are internal state employees performing direct implementation of grant activities. The personnel and fringe costs of these employees were not calcluated in the total estimated administrative costs of the grant.

K. Total Amount Requested	**$621,991**

Lead Testing in School and Child Care Program Drinking Water Grant
Arizona Department of Health Services

Summary Statement

Lead is a naturally occurring heavy metal, but most human exposures to high lead levels in the environment are due to human activities. Lead has been widely used in a variety of products and materials such as pipes, paints, ceramics, and gasoline. When ingested or inhaled, lead can have adverse effects on nearly all organ systems in the body. Children under the age of six years are especially at risk because they are still developing, absorb lead easily, and have a tendency to put their hands and objects in their mouths. Lead exposure often occurs with no obvious signs and symptoms. In children, lead poisoning can cause slowed development, reading and other learning problems, behavioral problems, as well as brain, liver, and kidney damage.

The Arizona Department of Health Services (ADHS) has been and remains committed to addressing lead exposure through drinking water in child care facilities and public schools in Arizona. In 2017, ADHS undertook a statewide project to test drinking water in licensed child care facilities across the state. Over 2,000 drinking water samples were collected and analyzed from 1,055 facilities. In addition, the Arizona Department of Environmental Quality tested over 16,000 samples of drinking water from 1,427 schools in 2016.

With the funding appropriated under section 1464(d) of the Safe Drinking Water Act, amended by the Water Infrastructure Improvement Act (WIIN) section 2107, ADHS will continue to address potential concerns of lead exposure through drinking water by testing drinking water fixtures in public charter schools, which were not part of the two testing projects previously conducted. Public charter schools serving younger children, underserved communities or housed in older buildings will be prioritized first for testing.

ADHS will utilize the U.S. Environmental Program Agency's (EPA) 3Ts guidance as a model for this program:

- **Communication:** ADHS will ensure communication throughout the implementation of the program by sharing the results and important lead information with school staff, parents, and the public.
- **Training:** ADHS will train program personnel, contractors, school staff, community partners, and parents on the risks of lead in drinking water, testing opportunities, as well as developing partnerships to support the program.
- **Testing:** ADHS will test drinking water fixtures using appropriate testing protocols and ADHS' certified public health laboratory.
- **Taking Action:** ADHS will develop a response plan and address potentially elevated lead concentrations where necessary.

Scope of Work

This section is a discussion of how ADHS will develop and implement the lead testing program in public charter schools.

I. State Goals and Priorities

While drinking water has not historically been found to be a cause of lead poisoning in Arizona, this program is aligned with ADHS' mission to promote, protect, and improve the health and wellness of individuals and communities in Arizona. ADHS' goal with this program is to reduce lead exposure in children by testing drinking water for lead, identifying potential sources of lead, and taking action.

ADHS has identified priorities consistent with the EPA's State Lead Testing in School and Child Care Program Drinking Water Grant Implementation Document. ADHS will offer voluntary drinking water testing to public charter schools across the state. Per the Arizona Department of Education website, there are approximately 650 public charter schools operating currently. Public charter schools serving younger children (less than six years of age), lower income, and housed in older buildings will be prioritized for testing services first. Using these priorities, specific program goals include

- Offering services to test drinking water fixtures to public charter schools serving younger children, especially those under 6 years of age, first.
- Offering services to test drinking water fixtures of all public charter schools in Arizona by the end of the project period.
- Providing education about lead exposure and the importance of testing to all public charter schools.

II. Program Implementation and Activities

ADHS will develop a drinking water testing program utilizing the EPA's 3Ts model. This includes (1) **communicating** the importance of preventing lead poisoning in children, drinking water testing services, as well as the results of testing performed to school staff, parents, and made available to the public; (2) **training** program staff, schools, parents, and community stakeholders on health effects of lead poisoning and potential sources, and water testing best practices; (3) **testing** drinking water fixtures using an appropriate protocol and certified laboratory; and **(4) taking action** by developing a response plan and addressing potentially elevated lead concentrations in drinking water when appropriate.

Below are specific activities to be conducted in these key areas.

Communication: ADHS will establish partnerships with key stakeholders to support programmatic efforts and ensure communication throughout the implementation of the program by sharing the results and important lead information with school staff,

parents, and the public before, during, and after the sampling program, and periodically as requested. Communications will be released timely as follows

- Schools will be notified of the testing opportunity before the implementation and individually during the scheduling of sampling.
- Testing results will be shared with the school published online as soon as possible but no more than 2 weeks following the receipt of the final results.
- Department messaging through director's blogs and social media will be released throughout the program to notify the public.
- General public education and updates on testing will be made available on the program's webpage and updated on at least a bi-weekly basis.

Multiple communication channels will be utilized to reach the targeted audience and increase participation in this program. Department messaging channels may include the agency's director's blog, emails, website updates, newsletters reaching the target audience, social media, and presentations to key stakeholder groups.

Targeted audiences include public charter schools, the school community (parents, teachers, and staff), local community organizations (county health departments, health care providers, housing programs and other community groups) and the drinking water community (utilities serving schools).

Training: Training will be provided to program personnel, contractors, school staff, community partners, and parents on the risks of lead in drinking water, testing opportunities. ADHS will also post resources and materials on the program's webpage. Training content will include health effects of lead exposure in drinking water, program goals and plan, as well as sampling procedures.

ADHS will work with county health departments to conduct the sampling. County health departments will be required to complete training before sampling can begin.

Testing: ADHS will be utilizing the EPA's 3Ts guidance 2-step sampling protocol and the ADHS state public health laboratory, which is certified to test lead in drinking water. Up to 10 drinking water fixtures (20 samples) will be sampled per school. ADHS will develop a Quality Assurance Project Plan and ensure the plan is reviewed and approved by the EPA prior to conducting any sampling. In addition, the Program will work with the ADHS public health laboratory to develop protocols for submitting and processing the samples. Arizona has approximately 650 public charter schools across the state. ADHS will offer testing services to all public charter schools and expects to sample at least 60% of these schools with this voluntary program. Based on previous water testing programs, ADHS expects less than 10% of the public charter schools will need additional follow-up testing. Sampling efforts will be properly coded and recorded utilizing the recommendations identified in the 3Ts guidance.

Taking Action: ADHS will develop a plan for responding to results of testing conducted. Additional guidance and recommendations will be provided to public charter schools when elevated lead concentrations are identified. Remediation recommendations will follow those outlined in the 3Ts guidance. ADHS will use the EPA's action level for the federal Lead and Copper Rule, 15 parts per billion, as the level to initiate remediation recommendations and further testing. The response plan will also incorporate sampling post-remediation to ensure remediation actions are effective in reducing lead levels in the drinking water. The ADHS Taking Action Plan can be found in Appendix A.

III. Roles and Responsibilities

3Ts Program Contact/ Principal Investigator: Point of contact overseeing the implementation of the grant by ensuring activities are implemented timely by key staff listed below, including communication, sampling, sample analysis, and additional actions when necessary.	Amber Asburry Arizona Department of Health Services 150 N 18th Ave, Ste 140 Phoenix, AZ 85007 Amber.asburry@azdhs.gov
State Public Health Laboratory Manager: Oversees the laboratory staff and will ensure appropriate EPA methods are utilized; analysis and result notifications are done timely.	Jason Mihalic Arizona Department of Health Services 250 N 17th Ave Phoenix, AZ 85007 Jason.mihalic@azdhs.gov
Laboratory Analyst: This person will be responsible for analyzing drinking water samples for lead using EPA method 200.8.	Arizona Department of Health Services 250 N 17th Ave Phoenix, AZ 85007
Epidemiologist/ Data Manager: This person will be responsible for maintaining data associated with the grant, including maintaining a list of schools tested, associated results, and status of laboratory testing and notification. This person will also assist in prioritizing schools for testing. This person will also coordinate with the agency's media team to maintain the website.	Vacant Arizona Department of Health Services 150 N 18th Ave, Ste 140 Phoenix, AZ 85007
Communication Liaison: This person will be responsible for communication activities including training on lead exposure, contacting public charter schools and stakeholders for interest and	Vacant Contractor, Knowledge Services Housed at the Arizona Department of Health Services

support in the program, providing technical assistance to county health departments, ensuring results are shared back with facilities, and recommended remediation actions are communicated when necessary. This person will also assist in developing sampling plans for schools.	150 N 18th Ave Ste 140 Phoenix, AZ 85007
Sampling Execution Staff: County health departments will coordinate and collect drinking water samples in public charter schools in their jurisdictions. Staff will work closely with the Communication Liaison.	Contracted services County health departments Locations across Arizona

IV. Timeline and Milestones

Quarter	Major Milestones	Major activities and tasks
CY2019, Quarter 4	Funding received	– Receive funding – Assemble program team – Develop program materials and webpage – Begin contractor agreement process, develop scopes of work – Work with the Department of Education and the Arizona State Board for Charter Schools to identify a final list of public charter schools
CY2020, Quarter 1	Department messaging announcing the program to the public Contracts are executed QAPP approved	– Finalize contractor agreements – Train program personnel – Prioritize list of public charters to be tested, send list to contractors – Ensure the ADHS Quality Assurance Project Plan is approved by EPA prior to sampling – Notify public charter schools of the program and the importance of preventing lead exposure
CY2020, Quarter 2	Sampling begins	– Coordinate participation of public charter schools in the program – Begin developing sample site plans and sampling at schools on the prioritized list

FY2020, Quarter 3		– Continue to coordinate participation and education of public charter schools in the program – Develop sample site plans and conduct sampling at schools on the prioritized list – Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results – Take action where elevated lead levels are identified – Support schools in community outreach – Conduct follow-up sampling where needed
CY2020, Quarter 4		– Continue to coordinate participation and education of public charter schools in the program – Develop sample site plans and conduct sampling at schools on the prioritized list – Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results – Take action where elevated lead levels are identified – Support schools in community outreach – Conduct follow-up sampling where needed
CY2021, Quarter 1	Completed sampling for 35% of public charter schools	– Continue to coordinate participation and education of public charter schools in the program – Develop sample site plans and conduct sampling at schools on the prioritized list – Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results – Take action where elevated lead levels are identified – Support schools in community outreach – Conduct follow-up sampling where needed
CY2021, Quarter		– Continue to coordinate participation and education of public charter schools in the program

2		– Develop sample site plans and conduct sampling at schools on the prioritized list – Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results – Take action where elevated lead levels are identified – Support schools in community outreach – Conduct follow-up sampling where needed
CY2021, Quarter 3		– Continue to coordinate participation and education of public charter schools in the program – Develop sample site plans and conduct sampling at schools on the prioritized list – Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results – Take action where elevated lead levels are identified – Support schools in community outreach – Conduct follow-up sampling where needed
CY2021, Quarter 4	Completed sampling for 100% of participating public charter schools Department messaging sharing program summary report to the public	– Complete remaining sampling (initial and follow-up) – Share remaining results of testing – Support schools in community outreach – Develop final report

V. WIIN Programmatic Priorities and EPA's Strategic Plan

The principal objective of this grant is to provide water testing services to public charter schools to identify potential lead contamination in drinking water, utilizing the EPA's 3Ts guidance. The objectives of the Program are

1. Reduce children's exposure to lead in drinking water
2. Provide water testing services to public charter schools not eligible for previous drinking water testing programs

3. Utilize the 3Ts model to establish best practices for a lead in drinking water prevention program
4. Foster sustainable partnerships at the state and local levels to allow for efficient use of resources and exchange of information
5. Enhance community, parent, and teacher cooperation and trust

The activities described in this work plan support the WIIN Programmatic Priorities and EPA's 2018-2022 Strategic Plan of "deliver[ing] real results to provide Americans with clean air, land, and water, and ensure chemical safety, as well as "ensur[ing] waters are clean through improved water infrastructure and, in partnership with states and tribes, sustainably manage programs to support drinking water, aquatic ecosystems, and recreational, economic, and subsistence activities."

VI. Anticipated Outcomes/Outputs

Outputs and short-term outcomes expected to be achieved under this agreement are described below.

Outputs

- Use the EPA's 3Ts for Reducing Lead in Drinking Water guidance to implement the state program;
- Development of a state lead testing in drinking water in public charter schools management strategy that supports a robust training, monitoring, and maintenance plan that protects children from lead exposure now and in the future;
- Prioritization of testing to target vulnerable communities and populations: schools in underserved and/or low-income communities; elementary and child care programs that primarily care for children 6 years and under; and older facilities that are more likely to contain lead plumbing;
- Providing results of any voluntary testing for lead contamination in school facility drinking water carried out using grant funds and notifying parents, teachers, and organizations of the availability of the results;
- Developing a regular lead testing program; and
- Establishment of routine practices such as those outlined in the 3Ts guidance.

Additional outputs include the development of contracts, intergovernmental agreements, a quality assurance project plan, blog posts, communication materials, program webpage, and a repository for results.

Short-term Outcomes

- Schools implementing a testing program and mitigating lead exposure by utilizing the 3Ts toolkit in determining best action to take for remediation;
- The reduction of children's exposure to lead in drinking water;

- Improvement of staff and community knowledge on lead in drinking water and other environmental harms;
- Water quality improvement and lead exposure reduction in drinking water; and
- Establishment of routine practices such as those outlined in the 3Ts guidance.

Other outcomes include fostering sustainable partnerships at the state and local level to allow for a more efficient use of resources and the exchange of information among various areas of school, utility, and health sectors, and the enhancement of community, parent, and teacher trust.

Program Partners

Arizona Department of Health Services State Public Health Laboratory
https://www.azdhs.gov/preparedness/state-laboratory/index.php

County Health Departments
15 county health departments across Arizona

Knowledge Services (Contractor Services)
https://www.knowledgeservices.com/contract/state-of-arizona/

Arizona Department of Environmental Quality
https://azdeq.gov/programs/water-quality-programs/safe-drinking-water

Arizona Department of Education
http://www.azed.gov/

Arizona State Board for Charter Schools
https://online.asbcs.az.gov/

Appendix A- ADHS Taking Action Response Plan

ADHS will use the EPA's action level for the federal Lead and Copper Rule, 15 parts per billion, as the screening level. ADHS will provide remediation recommendations and offer additional drinking water testing once remediation recommendations have been implemented or completed.

Part 1: School Notification of Water Lead Testing Results

Notify facilities of sampling results through project email within 2 weeks of receipt of laboratory reports using program email address.

1) **If all results are below the screening level**
   a) Use email notification "Email template for non-elevated screening results"
      i) Attach laboratory testing results
      ii) Attach non-elevated parent letter template
      iii) Provide link to 3Ts Establishing Routine Practices
      iv) Cc appropriate personnel
         (1) Local Health Department contacts
   b) Mail original laboratory results to school for record keeping
2) **If initial screening results are above the screening level and flushed results are below the screening level**
   a) Communication Liaison to contact local health department staff who conducted the sampling and notify of results.
   b) Local health department staff and Communication Liaison to coordinate phone call with school to notify of elevated results and recommend remediation per 3Ts guidance.
   c) Use email notification "Elevated initial results with non-elevated flushing results email template"
      i) Attach laboratory testing results
      ii) Attach elevated initial and non-elevated flushing parent letter template
      iii) Cc appropriate personnel
         (1) Bureau of Epidemiology and Disease Control Chief: Eugene Livar
         (2) Local health department contacts
      iv) Provide link to 3Ts Establishing Routine Practices
   d) Mail original laboratory results to school for record keeping
3) **If initial screening results are above the screening level and flushed results are above the screening level**
   a) Communication Liaison to contact local health department staff who conducted the sampling and notify of results.

b) Local health department staff and Communication Liaison to coordinate phone call with school to notify of elevated results and recommend remediation using 3T remediation options.
c) Use email notification "Elevated initial results with elevated flushing results email template"
    i) Attach laboratory testing results
    ii) Attach elevated initial and elevated flushing parent letter template
    iii) Cc appropriate personnel
        (1) Bureau of Epidemiology and Disease Control Chief: Eugene Livar
        (2) Local health department contacts
d) Mail original laboratory results to school for record keeping
e) Communication Liaison to maintain contact with school
    i) Reach out monthly for status update on repairs to plumbing or fixtures if no updates provided by the school
    ii) Once repairs are completed, offer post-remediation testing services
        (1) Local county health department will coordinate post-remediation testing with school
            (a) Follow above protocols for notification of post-remediation results

Part 2: Public Notification of Testing Results

The Epidemiologist/Data Manager will work with the web development team at ADHS to maintain list of results on the program website. Testing results will be published to the program website on a weekly to bi-weekly basis. Recommendations provided to schools with elevated concentrations will also be noted online.

Quality Assurance Project Plan
Arizona
Lead Testing for Drinking Water in Public Charter Schools in Arizona
WIIN 2107 Lead Testing in Schools and Child Care Facilities
Grant Number 99T90301

Prepared by
Arizona Department of Health Services
150 N 18th Avenue
Phoenix, AZ 85007
(602) 364-3118

Prepared for
EPA Region 9
75 Hawthorne Street
San Francisco, CA, 94105

Effective Date

Approvals Signature (required prior to project start):

_____ Date: 9/3/20
Arizona Department of Health Services, Principal Investigator

_____ Date: 9/4/20
Arizona Department of Health Services, Laboratory Quality Assurance Manager

_____ Date: 9/27/20
Arizona Department of Health Services, Assistant Director

_____ Date: 10/21/20
EPA Project Manager/Officer

_____ Date: 10/21/20
EPA QA Manager/Representative

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A-3 Distribution List

The following list of agencies and individuals will receive a copy of the QA Project Plan once approved.

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A-4 Project Organization

The primary agency responsible for lead testing in public charter school drinking water fixtures is the Arizona Department of Health Services (ADHS) Childhood Lead Poisoning Prevention Program (CLPPP). The Arizona State Public Health Laboratory (ASPHL) is certified to test lead in drinking water and will be conducting analyses on the collected samples.

Below are the outlined roles and responsibilities for each of the parties involved in testing public charter school water systems for lead. An organization chart depicting who each party will report to is shown in Figure 1-1 and Figure 1-2.

Principal Investigator, Jennifer Botsford will be responsible for administrative duties and overseeing the implementation of the grant. Ms. Botsford will ensure activities are implemented timely by key staff including communication with school staff, parents, key stakeholders and the public, sampling, sample analysis, and additional actions when necessary.

Epidemiologists/Data Managers, Carmen Tirdea and Jamaica Dillard, will be responsible for maintaining data associated with the grant including maintaining a list of schools tested, associated results, and status of laboratory testing and notification. Additional tasks consist of prioritizing schools for testing and coordinating with the agency's media team to maintain the website.

County Health Departments who have agreed to participate in the program will be responsible for managing drinking water sample collection within their respective jurisdictions, being a liaison to public charter schools, and submitting routine reports to the CLPPP. Their tasks will include contacting and scheduling water sampling collection with public charter schools, developing sampling plans for each public charter school, collecting water samples following ADHS protocols and submitting the water samples to the ASPHL, and providing water sampling results to the public charter schools and recommendations for further evaluation if results are above the EPA action level. County health departments will also submit monthly progress reports on public charter school testing status and quarterly expenditure reports to the ADHS CLPPP.

Laboratory Analysts at the ASPHL, trained and competent in the EPA Method 200.8, will be responsible for performing the analysis, review and reporting of drinking water samples for lead. The Laboratory is accredited by the EPA Region 9 for Drinking Water analysis using EPA method 200.8.

State Public Health Laboratory Manager, Jason Mihalic, will oversee the laboratory staff and ensure that appropriate EPA methods are utilized. Mr. Mihalic will also ensure that analysis and result notifications are done in a timely manner.

Communication Liaison, Ca'Lia Harris, will be responsible for communication activities including training on lead exposure, contacting public charter schools and stakeholders for interest and support in the program, providing technical assistance to county health departments, ensuring results are shared back with facilities, and ensuring recommendation remediation actions are communicated when

necessary. This person will also assist in the development of sampling plans for the public charter schools.

State Public Health Laboratory Quality Assurance Manager, Kathryn Wangsness, is independent of the laboratory testing sections and oversees the development and maintenance of the quality assurance and quality improvement programs. This includes maintaining EPA Safe Drinking Water Certification for the methods used in this project and includes periodic review of data packets and quality systems.

A-5 Problem Definition/Background

Lead is a naturally occurring heavy metal, but most human exposures to high lead levels in the environment are due to human activities. Lead has been widely used in a variety of products and materials such as pipes, paints, ceramics, and gasoline. When ingested or inhaled, lead can have adverse effects on nearly all organ systems in the body. Even small doses of lead can be harmful. Unlike most other contaminants, lead is stored in our bones, to be released later into the bloodstream. Thus, even small doses can accumulate and become significant. Children under the age of six years are especially at risk because they are still developing, absorb lead easily, and have a tendency to put their hands and objects in their mouths. Lead exposure often occurs with no obvious signs and symptoms. In children, lead poisoning can cause slowed development, reading and other learning problems, behavioral problems, as well as brain, liver, and kidney damage.

The degree of harm from lead exposure depends on several factors including frequency, duration, and dose of the exposure(s) and individual susceptibility factors (age, previous exposure history, nutrition, health). In addition, the degree of harm depends on one's total exposure to lead from all sources in the environment-air, soil, dust, food, and water.

Authorized under the Water Infrastructure Improvements for the Nation (WIIN) Act, the Lead Testing in School and Child Care Program Drinking Water Grant creates a voluntary program to assist with testing for lead in drinking water at schools and child care programs.

Nearly 56 million Americans, including 53 million children, spend their days in schools. School officials need to know if the drinking water students, teachers, and staff consume contains elevated levels of lead because exposure to lead can cause serious health problems, particularly for young children. The U.S. Environmental Protection Agency (EPA) developed the 3Ts for Reducing Lead in Drinking Water in Schools: Revised Technical Guidance to assist schools in safeguarding their occupant's health.

Corrosion: Lead can get into drinking water after the water leaves the treatment plant or well and contacts the plumbing materials containing lead. The physical/chemical interaction that occurs between the water and the plumbing is referred to as corrosion. The extent to which corrosion occurs contributes to the amount of lead that can be picked up by the drinking water. Lead can enter drinking water when plumbing materials that contain lead corrode, especially where the water has high acidity or low mineral content that corrodes pipes and fixtures. The most common sources of lead in drinking water are lead pipes, faucets, and fixtures. Lead pipes are more likely to be found in older buildings built before 1986.

Although public water systems that supply water to most schools may meet EPA's lead standards, lead can still get into school drinking water. As water moves through a school's plumbing system, lead can leach into the drinking water from plumbing materials and fixtures that contain lead. Testing is the best way for schools to know if there are elevated levels of lead in a facility's drinking water.

ADHS has been and remains committed to addressing lead exposure through drinking water in child care facilities and public schools in Arizona. In 2017, ADHS undertook a statewide project to test drinking water in licensed child care facilities across the state. Over 2,000 drinking water samples were collected and analyzed from 1,055 facilities. In addition, the Arizona Department of Environmental Quality tested over 16,000 samples of drinking water from 1,427 schools in 2016.

ADHS will continue to address potential concerns of lead exposure through drinking water by testing drinking water fixtures in public charter schools, which were not part of the two testing projects previously conducted. Public charter schools serving younger children, underserved communities or housed in older buildings will be prioritized first for testing.

In Arizona, there are approximately 542 public charter schools serving kindergarten through high school. Based on the information available on the Arizona Department of Education website, ADHS collected the dates each charter school was opened, however, these dates are not reflective of the dates when these buildings were built. There are 330 charter schools opened between 1991-2009, 123 schools opened between 2010- 2018 and 89 charter schools where the opening year is unknown. Since ADHS does not have the information of the year each building was built, ADHS and the contracted county health departments will prioritize testing first the charter schools serving grades kindergarten through fifth grade - a total of 333 schools, second will test the schools serving grades sixth through eighth - a total of 69 schools, and lastly schools serving grades ninth through twelfth - a total of 140 schools.

A-6 Project/Task Description and Schedule

By the end of the grant period, a total of 542 public charter schools will have the opportunity to have their drinking water tested for lead. As this is a voluntary program, ADHS expects to sample at least 60% of these schools and, based off of previous water testing programs, less than 10% of the public charter schools will require additional follow-up testing. Up to 10 drinking water fixtures (20 samples) will be sampled per school. All samples will be taken according to the EPA's 3Ts guidance two-step sampling (Appendix A) from the fixture and each fixture will not have water stagnant for more than 18 hours prior to sample collection to ensure that the samples are representative of exposures school children and staff may experience. After collection, samples will be sent to the ASPHL and analyzed for lead.

The project will consist of 4 parts:

Part 1: Identification and prioritization of schools

Part 2: Conduct a plumbing profile and sampling plan to identify potential sampling locations within facilities and to confirm if any water coolers contain lead components by cross referencing the model number with EPA's document entitled 3Ts for Reducing Lead in Drinking Water in Schools document (EPA 815-B-18-007; October 2018) in Appendix B.

Part 3: Conduct sampling of water coolers and kitchen sinks.

Part 4: Reporting of results

Of the 15 counties in Arizona. four counties including Coconino, Mohave, Navajo, and Yuma counties have agreed to participate in the program sampling activities. These counties will be responsible for coordinating testing in public charter schools within their respective jurisdictions. ADHS will create a sampling plan and coordinate testing at the public charter schools in the remaining counties through a contractor. Initial and follow-up sampling is expected to be completed by the end of second year of the grant period along with the final reports to the public charter schools with the sample results.

A quarterly breakdown of the major milestones and each associated activity and task is outlined below.

Quarter	**Major Milestones**	**Major activities and tasks**
FY2020, Quarter 2	Funding received	− Receive funding − Assemble program team − Develop program materials and webpage − Begin contractor agreement process, develop scopes of work − Work with the Department of Education and the Arizona State Board for Charter Schools to identify a final list of public charter schools
FY2020, Quarter 3	Department messaging announcing the program to the public Contracts are executed	− Finalize contractor agreements − Train program personnel − Prioritize list of public charters to be tested, send list to contractors − Work with the EPA to finalize a Quality Assurance Project Plan for sampling − Notify public charter schools of the program and importance of preventing lead exposure

	Sampling begins	- Coordinate participation of public charter schools in the program - Begin developing sample site plans and sampling at schools on the prioritized list - Develop sample site plans and conduct sampling at schools on the prioritized list - Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results - Take action where elevated lead levels are identified - Support schools in community outreach - Conduct follow-up sampling where needed
FY2020, Quarter 4		- Continue to coordinate participation and education of public charter schools in the program - Develop sample site plans and conduct sampling at schools on the prioritized list - Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results - Take action where elevated lead levels are identified - Support schools in community outreach - Conduct follow-up sampling where needed
FY2021, Quarter 1	Completed sampling for 35% of public charter schools	- Continue to coordinate participation and education of public charter schools in the program - Develop sample site plans and conduct sampling at schools on the prioritized list - Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results - Take action where elevated lead levels are identified - Support schools in community outreach - Conduct follow-up sampling where needed

FY2021, Quarter 2		− Continue to coordinate participation and education of public charter schools in the program − Develop sample site plans and conduct sampling at schools on the prioritized list − Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results − Take action where elevated lead levels are identified − Support schools in community outreach − Conduct follow-up sampling where needed
FY2021, Quarter 3		− Continue to coordinate participation and education of public charter schools in the program − Develop sample site plans and conduct sampling at schools on the prioritized list − Share results of the testing as soon as possible but no later than 2 weeks after the receipt of results − Take action where elevated lead levels are identified − Support schools in community outreach − Conduct follow-up sampling where needed
FY2021, Quarter 4	Completed sampling for 100% of participating public charter schools Director's blog on summary of program	− Complete remaining sampling (initial and follow-up) − Share remaining results of testing − Support schools in community outreach − Develop final report

A-7 Quality Objectives and Criteria for Measurement Data

ASPHL has established policies, protocols and quality standards for accepting and analyzing water using EPA methods. ASPHL's policies, procedures, and standards will serve as the program's quality standards as well.

Quality control procedures defined by the ASPHL Laboratory Quality Assurance Manual (QAM) will be followed during sample receiving and log-in, sample preservation, and sample analysis. Whenever possible a field blank will be placed into the sample set as an internal quality control parameter. Finished

drinking water samples for lead analyses will undergo quality control checks at sample receiving and log-in. The State Public Health Laboratory will determine if samples are within 14-days of sample collection following the laboratory's procedures and quality management system. Samples received past 14 days of collection date will be rejected. Should any issues arise during sample receiving and log-in, such as leaking containers, incorrect sample identification codes or missing paperwork, the Arizona Public Health Laboratory Quality Assurance Manager will inform the EPA Reporting team and CLPPP.

The ASPHL will follow their internal quality control practices regarding EPA Method 200.8. Should any quality control issues arise during sample analysis, such as instrument failures, spilled samples, carry over issues, or quality control failures, the State Public Health Laboratory Manager or Quality Assurance Manager will inform CLPPP.

Each batch of samples undergoing analyses under EPA Method 200.8 using inductively coupled plasma-mass spectrometry for the analysis of lead will have at minimum the following quality control samples associated with it, Laboratory Reagent Blank, Laboratory Fortified Blank, Laboratory/Quality Control Samples (L/QCS), Laboratory Fortified Matrix, and Duplicates.

Objectives and Project Decisions

The intent behind testing public charter school's drinking water for lead is to build upon previous sampling projects aimed at characterizing the lead content of public charter school facilities' drinking water in the state of Arizona. The initial sampling will enable ADHS to determine if there is a risk of lead exposure at schools within the state while follow-up testing will assist schools that exceed the regulatory limit.

The primary goals of this project are to (1) offer services to test drinking water fixtures to public charter schools serving younger children, especially those under 6 years of age, first, (2) offer services to test drinking water fixtures of all public charter schools in Arizona by the end of the project period, and (3) provide education about lead exposure and the importance of testing to all public charter schools.

Sample data will be compared to the Lead and Copper Rule (LCR) limit of 15 parts per billion (ppb) of lead. Decisions to be made with the data include:

- All facilities will be notified of the results for each sample taken on the premises, including results below the LCR.
- If data for any sample at a public charter school are found to exceed the LCR limit in the initial sample or the flush sample, then a plan for subsequent follow-up testing will be coordinated with the facility, and recommendations will be made to mitigate the risk for lead exposure.
- If during the second round of sampling, a follow-up post-flush sample is found to exceed the LCR limit, then recommendations will be made to the facility to replace or repair the fixture.

Action Limits/Levels

Per the Lead and Copper Rule, 56 FR 26460 - 26564, published in 1991, the action level for lead in drinking water supplied through community water systems and non-transient non-community water systems is 15 ppb. ADHS will provide recommendations to public charter schools for further investigation into the source of the lead in the drinking water fixture.

Table 1-1. Analytical Parameters and Target Limits

Analytical Parameter	Project Action Limit (µg/L or ppb)	ASPHL reporting level (µg/L or ppb)
Lead	15	2

Measurement Performance Criteria/Acceptance Criteria

Water samples will be collected according to the EPA's 3Ts sampling protocols. Samples will be submitted to the laboratory within 12 days in order to provide the laboratory time to preserve the sample within the accepted time frame prior to analysis. Any sample received greater than 14 days after collection will be rejected and will be resampled where possible. The laboratory will follow the established quality assurance system and EPA Method 200.8 for analyzing samples to ensure data of known quality.

The ASPHL staff follow the Quality Assurance Manual (QAM) (Appendix C) along with section and method specific procedures, specifically for EPA Method 200.8. The QAM provides an overview on handling test and calibration items (Section 5.8), ensuring the quality of test and calibration results (Section 5.9), and Reporting Results (Section 5.10). From this document the sections build out specific procedures that provide greater detail on the use of the laboratory information management system (STARLiMS), the analysis of samples by the test method and supporting quality activities. Any event that is deemed to be outside of acceptable criteria is followed up with established processes such as reanalyzing samples and or performing a root cause analysis. The ASPHL quality system requires data generated to be reviewed by a peer, someone other than the individual that produced the data, and documented as to who performed the review, at a minimum the date of the review, and any notes regarding the data.

Any data not meeting method acceptance criteria will be reanalyzed so that data provided to the program will consist of known quality data. The program will not use results for any sample not meeting sampling, storage or data acceptance criteria.

A-8 Special Training Requirements/Certification

Field Sampling and Measurement Personnel

No certification of field personnel is required for this program. ADHS will work with interested county health departments to conduct sampling. A contractor will be hired to conduct sampling in counties not receiving funding. Sampling personnel will be required to complete the ADHS-developed training before sampling can begin to ensure samples are collected according to the EPA's 3Ts and as described in this QAPP. Training content will include health effects of lead exposure in drinking water, program goals and plan, as well as preparing for and collecting water samples. Training will consist of conference calls, webinars, hand-out materials, and practice sessions as needed.

Laboratory Personnel

Laboratory personnel hired to work at ASPHL have at least a bachelor's degree in laboratory science when hired and are provided the ASPHL Training Policy to review and acknowledge. The training outlined in the laboratory's QAM and CHEM-002 Training and Competency Assessments for the Performance of Chemistry Testing Protocols, ensure that personnel performing designated tasks have participated in rigorous and ongoing training associated with those tasks. Records of laboratory personnel training and competencies are maintained at the laboratory.

A-9 Documents and Records

Laboratory reports will be generated by the ASPHL for all samples received by the laboratory. Data will be released by the laboratory after internal quality control reviews. Each set of samples from each individual charter school will be assigned a unique project number upon arrival at the laboratory.

Once data is released, the ASPHL will provide sample result reports to the submitting county health department which will be responsible to send these reports to the appropriate charter school. ADHS CLPPP will receive the reports for water samples submitted by the contractor to notify public charter schools of results. Should any result exceed the Action Level of 0.015 mg/L for lead, notification (Appendix D) will follow the recommendations of the WIIN Act.

Records of chemical analyses shall be kept for not less than 10 years along with field logs, sample demographics, and field notes. These documents will be kept by the ASPHL and on ADHS' secured computer network.

The ASPHL will also send weekly reports to CLPPP of samples received, including those submitted by participating county health departments, and analyzed for electronic record keeping and data management. Quarterly management progress reports will be generated to provide status of the program along with any other issues or concerns.

QA Project Plan Distribution

The ADHS CLPPP Data Managers/Epidemiologists are responsible for approving and maintaining revised versions of the QA Project Plan. The CLPPP Project Manager is responsible for distributing the QA Project Plan to each of the agencies and individuals previously listed in Section A-3.

Field Documentation and Records

In the field, records will be documented on ADHS approved forms. All sampling activities will be conducted according to the 3T's protocol (Appendix A) which will be distributed to the counties and the contractor prior to sampling. Prior to sampling, counties and the contractor must complete a sampling plan (Appendix E) for each school to determine how sampling sites will be chosen and prioritized and a sample schedule (Appendix F) outlining when schools are to be tested. Any documentation generated prior to and during sampling events will be submitted to the ASPHL and will be kept on file both physically and scanned to be stored digitally at ADHS for access by CLPPP and ASPHL.

A field sampling log (Appendix G) will be used to document all observations and samples taken during each sampling event. These logs will be submitted by the counties and the contractor to the ASPHL in addition to laboratory submission forms. Information included on the sampling log include:

- Facility name
- Facility map with sample locations labeled
- Name of sample collector(s)
- Unique sample ID numbers
- Sample type (initial first draw, flush, etc.)
- Date and time of sample collection
- Location of samples
- Attachments (if any) on the fixture
- Additional observations(ex. discoloration of water, odor, etc.)

If a fixture exceeds the action limit for lead, additional information may be collected on that fixture to determine the source of lead including:

- Name of the outlet manufacturer and model number, if available
- Model number of faucets, valves, and other fixtures
- Water treatment already in place in the building

All samples will be labeled clearly and accurately for identification and tracking purposes. A template for the labels (Appendix H) will be provided to the counties and contractors. Labels will be filled out and affixed onto each sample bottle and documented on the sampling log. Sample labels will contain, at a minimum, the following information:

- Unique sample ID number
- Location of sample
- Sample type

- Date and time of sample collection
- Initials of the sample collector

Laboratory Documentation and Records

The current approved Quality Assurance Project Plan (QAPP) will be made available to all staff by being kept in a central location and uncontrolled copies provided to those not able to access the central location. The laboratory follows QA-024, Document Control, which ensures that procedures and forms in use are current and approved for use. Records generated in the process of receiving, processing, analyzing and reporting samples are retained per the records retention requirements located in the ASPHL QAM, Section 4.13 Control of Records. Additional records retention requirements can be located through the Arizona State Library, Archives & Public Records at https://azlibrary.gov/arm/retention-schedules.

Final reports will be generated as per the ASPHL QAM, Section 5.10 Reporting Results and Appendix B Final Report Elements.

Quarterly and/or Final Reports

The ADHS CLPPP Program Manager and Communication Liaison are responsible for the preparation of quarterly reports and annual reports that are to be submitted to the US EPA Grants Project Officer. ADHS will prepare quarterly reports and annual reports according to the grant agreement.

As described in the grant agreement, each of the quarterly reports should include performance information on each of the following areas:

- A comparison of actual accomplishments to the outputs/outcomes established in the assistance agreement work plan for the period;
- The reasons for slippage, if established outputs/outcomes were not met;
- Monies expended towards completing the different work plan tasks; and
- Additional pertinent information, including, when appropriate, analysis and information of costs overrun or high unit costs

Additional required reports include:

- **Annual Reports**: Annual performance progress reports are required. Information must include key project characteristics, milestones, and public health protection results in the following areas:
    - achievement of the outputs and outcomes established in the workplan;
    - reasons for delays, if established outputs or outcomes were not met;
    - any additional pertinent information on public health results pertaining to testing for lead in drinking water in schools or child care facilities.
    - any related activities, including the development and provision of training courses, roundtables, webinars, tools, other products, and outreach materials. For reach of these activities, recipients must report on their outputs and outcomes such as the types of actions taken to reduce lead in drinking water in the tested facilities; the number of

communities with increased information about the health effects of lead, the number of facilities implementing drinking water routine maintenance programs, the number of schools and child care personnel that received training on lead in drinking water, and other outcomes that support protecting children from exposure to lead in drinking water.

- **Final Report**: The final report shall be submitted to the EPA within 90 calendar days of the project/budget period end date. The final report shall include:
    - a narrative summary of the project and project results (outputs and outcomes), including the success and lessons learned from the entire project;
    - all categories of information required for quarterly reporting, including a final, detailed program description of the testing conducted; and
    - a report on subaward oversight, including summaries of results of reviews of financial and programmatic reports, summaries of findings from site visits and/or desk reviews to ensure effective subrecipient performance, environmental results achieved by the subrecipient, summaries of any audit findings and related pass-through entity management decisions, and any actions the subaward entity has taken to correct deficiencies; and
    - copies of publications and/or presentations based on this project.

B-1 Sampling Design (Experimental Design)

Each of the 541 public charter schools (one school excluded as it was exclusively online) will be offered the opportunity to participate in this voluntary program and have their water fixtures tested for lead. At each site, the number of samples are dependent on the size of the building, the number of water fixtures, number of water taps, and other drinking water taps. Of the schools that agree to participate in the program, up to 10 fixtures will be sampled per facility.

Sampling locations will be determined from Part 1 and Part 2 of the project. Once facilities are identified, a plumbing profile and sampling plan can be utilized to identify potential sampling locations within the facility and determine the exact number of samples. Should a sampling location be identified as a water cooler referenced in EPA's document entitled 3Ts for Reducing Lead in Drinking Water in Schools document (EPA 815-B-18-007; October 2018) in Appendix B, the sampling location will not be sampled and the facility will be notified that a water cooler on its premises contains lead and it is recommended that it be turned off and removed. The analytical parameter of interest that will be measured will be lead in finished drinking water using EPA Method 200.8 Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma –Mass Spectrometry and performed by the ASPHL.

Drinking water fixtures will be prioritized for sampling on the use of the fixture by students, especially younger ages, and location, such as in the gymnasium or outside by the playground. All samples will be taken in accordance with the EPA's 3T's guidance on two-step testing therefore, each fixture will be sampled twice.

The 4 local county health departments that agreed to participate in the project are responsible for creating a sampling plan and coordinating sampling with each of the public charter schools in their jurisdictions.

It is the goal of ADHS to test the water systems for all public charter schools that agree to participate in the program; however, a strategy is in place to prioritize which schools will be tested first. County personnel and the contractor will make efforts to identify the year built for each facility. The facilities receiving highest priorities are those serving grades kindergarten through fifth grade. Following these facilities, schools that serve grades sixth through eighth will be tested and finally, any schools serving grades ninth through twelfth will be tested. Sampling is prioritized based on grade because lead has more harmful long-term consequences in younger children as they are still developing.

B-2 Sampling Methods

All samples will be collected according to the 3Ts sampling protocol (Appendix A). Sample supplies will be purchased by the laboratory to ensure appropriate materials are used. A field blank will be a sample bottle provided by the Laboratory and filled with deionized water. It is to be kept in the sample storage location (i.e., box or ice chest) for the duration of the trip.

Samples will be taken in 250 mL nalgene certified metals free bottles provided by the ASPHL. Field acidification is not recommended. However, collected samples must be submitted to the Laboratory within 14 days of collection and kept in a temperature controlled environment, so as to inhibit bacterial growth, prior to submission. Decontamination procedures in the field will not be necessary as each of the samples will be collected directly into the bottles provided by and submitted to the laboratory.

Per EPA guidance on two-step sampling, two samples will be taken from each fixture. The first draw sample will be a 250 mL first draw after a stagnation period of 8 to 18 hours, preferably before the facility opens to ensure that the fixtures have not been used yet for the day. If the first draw sample is elevated, the fixture could potentially contain lead. The fixture will then be flushed for 30 seconds and another 250 mL sample will be taken. If the flush sample is high, then the plumbing behind the fixture may contain lead.

No aerators or other filters will be removed during sampling to ensure that the sample is representative of the water children and staff are routinely using. If samples test high for lead (Pb), future follow-up sampling may need to look into removing aerators to determine if debris is contributing to high lead concentrations.

If a fixture has lead content exceeding the LCR limit of 15 ppb, the county or contractor will provide the facility with recommendations on lead mitigation strategies and schedule follow-up sampling. Every fixture in that public charter school will be sampled during follow-up sampling. During these circumstances, a field blank will be taken and submitted with all samples to the ASPHL for analysis.

B-3 Sample Handling and Custody

Each water sample is collected in a certified trace-metals clean Nalgene, or like plastic, bottle. The ideal volume for collection is 250 mL. Note the date, time, location, and any other identifying information (i.e., unique identifier) of the sample on the side of the bottle using a permanent marker (i.e., Sharpie). Samples do not need field acidification as each will be acidified with ultra clean nitric acid in the laboratory upon receipt. If a sampler desires to field acidify the individual must communicate that fact with the ADHS Laboratory so that the lab may assess the quality of nitric acid used in the field as well as the sampler's understanding of hazards inherent to working with strong acids.

Collected samples should be placed in an ice chest with solid ice present so as to maintain a temperature of ˂4°C to inhibit bacterial growth while in the field. This is particularly important during multi-day sampling trips or in situations in which the samples are in a hot vehicle during a long day trip (i.e, 8hr+). Once at a temperature controlled location, such as an air conditioned office, samples may be stored at room temperature while waiting for transport to the laboratory. Samples must be received at the laboratory within 14 days of sampling or they will be rejected. Depending on the means of transport, samples may be held at room temperature for the duration of the trip to the laboratory (i.e., inside a vehicle away from direct sunlight and excessive heat). However, if the samples are being transported in a non-temperature controlled location (i.e., back of a pick-up, trunk of a car) they should be stored in an ice chest with ice present. Laboratory courier pick-ups are at room temperature as the courier does not haul packages containing loose liquids.

Sample locations determined to have lead (Pb) present above the action limit of 15 ppb will be retested by ADHS staff using regulatory collection techniques. Specifically, the use of certified metals free bottles, use of a field blank, Chain of Custody (COC), and long distance transportation of the collected sample on ice (˂4°C). Field blanks will be prepared by the ASPHL using >18 Mega-ohm·cm (nanopure) water.

Incoming samples to the ASPHL are delivered to the Laboratory Receiving section and may be submitted in person or by Courier. The Laboratory is located at 250 North 17th Avenue, Phoenix, and the Receiving section is located at the NW corner of the building. Entrance to the Laboratory is obtained after ringing the doorbell at the top of the ramp and, first, opening the outer door and, second, the door to Receiving proper.

Submission Paperwork

Submission paperwork is located on the ADHS website (Appendix I).

ADHS Laboratory Public Health Chemistry Submission Form: Page 1

Page 1 is the lab request portion of the form and may be used for as many samples that are in a single submission. Please follow the instructions below in filling out the form.

- Submitting Agency Information: The following information will be transcribed onto the final laboratory report. Please fill out open fields for: Name, Street Address, City, State,

Zip Code, County, Contact Name, Contact Phone, and Sampler/Submitter. Please list a working email address that will be used to return copies of the completed form once laboratory accessioning numbers are assigned.

- Sample Matrix: It is anticipated that samples submitted for WIIN analysis will originate from either a municipal water source (Drinking Water) or private well (Ground Water). Please check the applicable box (i.e., if the source is municipal water, check "Drinking Water").
- Laboratory Testing Requested: The submitter is requesting a single element analysis. Check the box for "Lead" under "Metals – All Matrices" and add any comments deemed relevant to the collection in "Other Requests / Submitter Comments". Examples of past comments are, "Sample XYZ had a rust-like color" or "Sample LMN smells like rotten eggs" or "Sample ABC is half filled because the cap leaked".

ADHS Laboratory Public Health Chemistry Submission Form: Page 2

Page 2 is the sample identification and Chain of Custody portion of the form. Note that each form holds information for up to 10 samples. If more than 10 samples are collected please use as many "Page 2" documents as necessary. Please follow the instructions below in filling out the form.

- Laboratory Sample Number – Leave blank (this number is provided by laboratory accessioning)
- Sample Identification / Description – Use an identifying code unique to each sampling site and time at which the sample is collected. For example, a water fountain at Sandra Day O'Connor Charter School in Room 119 that was collected at first draw may be labeled "O'Connor RM119 WF T=0" or the like. Note that the unique identifier of the sample is tied to the Laboratory Sample Number on the final report. It is prudent to develop a sampling numbering scheme prior to collection.
- Date Sampled: List the date the water was collected in a MM/DD/YY format.
- Time Sampled: The time the water was collected may be in either a 12 or 24 hour format.
- Number of Containers: For WIIN collection this number is always 1.
- Preservative: Acidification will occur at the ADHS Laboratory. Leave blank or write "none".
- Chain of Custody Needed: Initial sampling of WIIN sites do not require chain of custody (COC). For initial sampling please check the "No" box. Sample locations determined to have lead (Pb) present above the action limit of 15 ppb will be retested by ADHS staff using regulatory collection techniques, which include COC. Please check the "Yes" box for confirmation samples.
- Chain of Custody Record:
  - If COC is not needed then leave this portion blank.
  - If COC is needed, please fill this portion out when submitting the sample(s) at the laboratory.

B-4 Analytical Methods

The WIIN analytical needs are for single element analysis, Lead (Pb), using an EPA Drinking Water (DW) method. The ASPHL holds EPA DW certification for metals analysis EPA Method 200.8, Determination of Trace Elements in Water and Wastes By Inductively Coupled Plasma – Mass Spectrometry, and will use this method to analyze WIIN samples for lead (Pb) using in-house SOP BLS-282.

The ASPHL will use a PerkinElmer NexION 300D Inductively Coupled Plasma Mass Spectrometer (ICP-MS) instrument for the analysis of WIIN samples. Analysts operating the instrument will have met the ASPHL Quality Assurance (QA) criteria for chemistry instrument and method training – which includes detailed instruction for instrument training, safety, standards preparation, sample analysis, troubleshooting, competency assessment, waste disposal, and the interpretation of results. Analysts will have met EPA accreditation requirements for both general analyses, as defined by the Laboratory Quality Assurance Manual, and the EPA in terms of method specific work (MDL, IDC, QC).

All samples submitted for WIIN analysis will be tested for turbidity and pH prior to analysis. The pH reading is accomplished by test strip and results recorded. Turbidity will be tested using a Turbidity meter and results recorded as per in-house process FBLS-029. Samples with turbidity $<$ 1 NTU will undergo acidification with clean nitric acid and, after a 16 hour hold, will be eligible for direct analysis by ICP-MS. Samples with a NTU of $\geq$1 will follow the Total Recoverable Analytes digestion procedure prior to analysis. Digestions for 200.8 analysis are performed on a DigiPrep Block unit using metals free plasticware.

B-5 Laboratory Analysis Quality Control

Laboratory analysis quality control for the WIIN project is performed under strict adherence to the quality assurance process outlined in the document ASPHL Quality Assurance Manual: Non-Clinical (Appendix C) and is used in concert with the method Standard Operating Procedure (SOP) under the umbrella of EPA drinking water accreditation. This criteria creates protocols for all aspects of the analytical process and includes, but is not limited to, traceability, corrective action, internal audits, document and record control, technical requirements, management reviews, calibration criteria, defining method validation, equipment and reagents, ensuring the quality of test results, and the reporting of results.

The ASPHL method SOP for EPA 200.8 is titled BLS-282 (Appendix J), is reviewed and updated periodically, and is specific with regards to the necessary quality control requirements for sample analysis. These include reagents, tuning solutions, calibration standards, internal standard spiking solutions and response criteria, blanks (LRB, LFB, Rinse), quality control samples (QCS), laboratory fortified matrix (LFM), duplicates, instrument performance check (IPC), as well as defining the instrument linear dynamic range (LDR) and method detection limit (MDL).

B-6 Instrument/Equipment Testing, Inspection, and Maintenance

Instruments will be maintained in accordance with the manufacturer's recommendations and detailed in the instrument user's manual. Analysts are trained in instrument maintenance, troubleshooting, and minor repair. The ASPHL maintains service contracts on critical instruments, including the ICP-MS unit in use for the WIIN analysis. Coverage includes an annual preventive maintenance performed by manufacturer certified technicians using OEM (original equipment manufacturer) parts.

Prior to analysis of WIIN samples, the analyst will perform daily instrument checks to ensure that the ICP-MS is functioning properly and within analytical specifications. This includes checking argon pressure, replacing pump tubing, ensuring that the waste container is empty, checking the vacuum pump oil and for any obstructions in the nebulizer/spray chamber before running the instrument diagnostics and record on the daily maintenance log sheet the main and interface water temperature and base vacuum pressure. Once the plasma is on and warmed-up the analyst will engage in a daily performance check to confirm that sensitivity, precision, and ion intensity criteria are met. Analysts are trained to optimize the instrument when necessary. Optimization includes cleaning or replacing the cones, torch, injector, coil and nebulizer/spray chamber and followed by optimizing the autolens and tuning for mass calibration and peak resolution.

If general maintenance denotes problems outside the ability of the analyst to perform the service contract vendor will be engaged to bring the instrument to optimum performance.

B-7 Instrument/Equipment Calibration and Frequency

Instrument/Equipment calibration and frequency will follow EPA Method 200.8 recommendations and ASPHL's QAM. Records of calibration shall be maintained by the ASPHL.

B-8 Inspection/Acceptance Requirements for Supplies and Consumables

Requirements for sampling are the use of bottles with screw cap tops and certified trace-metals clean Nalgene, or like plastic. The ideal bottle will be 250 mL volume and designed for the purpose of drinking water compliance sampling.

Requirements for laboratory plasticware are that they be either certified trace-metals clean or tested by laboratory staff to ensure that lead (Pb) is not a contaminant. Laboratory testing involves 10 pieces of plasticware to which an aliquot of certified trace metals clean nitric acid is added to each with a minimum of 8 hours of soak time. The leachate is then tested for the presence of lead (Pb).

Requirements for laboratory nitric acid is that it be certified trace-metals clean.Requirements of the analytical gas, argon, is that it be 99.9% pure. Requirements for QC, calibration, and internal standard materials are that they be National Institute of Standards and Technology (NIST) traceable. Requirements for instrument tuning solutions are that they meet the specification of the manufacturer. All instrument parts, including consumables, will be PerkinElmer OEM.

B-9 Data Acquisition Requirements (Non-Direct Measurements)

Efforts will be made to collect relevant data about the public charter school buildings, such as building age and plumbing and testing history information. In addition, a map of the public charter school will be collected/created to identify the sampling locations. The information will be used to better understand the context of the sampling results.

B-10 Data Management

Required sampling documentation will be provided to county health department personnel and the contractor to ensure all required information is collected during the water sampling process. Water samples will be submitted to the ASPHL using a standard approved laboratory sample submission form (Appendix I). ASPHL maintains their data electronically in the Laboratory Information System (LIMS) STARLIMS as well as a physical copy in a locked cabinet. ASPHL will send a weekly extract from StarLIMS to CLPPP with information on how many samples have been received by the laboratory for this project, how many samples are pending analysis, and the results of analyzed samples. In addition, ASPHL will prepare final reports for each water sample analyzed that will be shared with the public charter schools and counties, and ADHS CLPPP for samples submitted by the contractor.

In addition, the field sampling log will be submitted to ASPHL. ASPHL will scan and save in a shared folder for the CLPPP epidemiologists to retrieve for recordkeeping and entry into an electronic database.

Data management will be ongoing with routine assessments described in the below section.

C-1 Assessments/Oversight and Response Actions

The CLPPP data managers will review weekly extracts received from the laboratory for completeness and formatting. Data for this project will be housed in Microsoft Excel and prepared weekly for updating on the website. Analysis and data management will occur using SAS 9.4 software and include deduplication, identification of new results, missing results, as well as possible outliers, confounders, or anomalies based on sampling locations, building types, and geographic locations. Weekly data management will also include updating data to be posted on the website weekly.

An assessment of school sampling status will be conducted on a monthly basis, using a comparison to reporting of progress by contractors and results received from the laboratory. If the assessment identifies discrepancies, data managers will work with the laboratory and/or contractors to resolve. A metric will be developed and discussed during program meetings. The program will also assess progress in meeting performance benchmarks as described in the work plan, such as percentage of schools sampled.

Assessments will be reported to the CLPPP program manager and Laboratory Manager to track progress. If assessments identify delays or deficiencies, reports will be shared with upline management

for further discussion, as well as assessment of progress with the contractor to identify and address barriers.

Laboratory Assessment Plan

The ASPHL Quality Assurance (QA) program conducts yearly audits of the Environmental Program, which will include work performed on WIIN samples. All data generated at the ASPHL meets the pre-analytical / analytical / post-analytical criteria as outlined in the ASPHL QAM. Incidences of failure are met with corrective action, which demand a 3-part timed review that must be completed within 90 days of the failure. The ASPHL QA Office is staffed by three officers proficient in EPA, CLIA, and ISO/IEC 17025 accreditation criteria.

C-2 Reports to Management

Data managers will produce monthly status reports for the CLPPP manager as described above. In addition, counties conducting sampling of facilities in their jurisdictions will be required to submit monthly reports to the CLPPP manager for approval. These reports will be prepared by the designated representatives at the county level. The CLPPP manager must approve these reports before funding is reimbursed to the contractor.
These reports will include :

- Number of charter schools selected for sampling
- Number of charter schools sampled
- Number of samples generated
- Pending number of samples
- Number of completed reports
- Number of samples with lead action level exceedances

Data received from the contractors, laboratory, and counties will be synthesized and produced by the CLPPP data managers and program manager and shared to the EPA Region 9 Project Manager per the required reporting requirements.

Reports to EPA Management will be created on a quarterly basis, and will consist of the following:

- Number of schools selected for sampling
- Number of schools sampled
- Number of samples generated
- Pending number of samples
- Number of completed reports
- Number of water coolers matching the model number listed in EPA's document entitled 3Ts for Reducing Lead in Drinking Water in Schools document (EPA 815-B-18-007; October 2018) in Appendix B.
- Number of samples with lead action level exceedances

D-1 Data Review, Verification, and Validation Requirements

The criteria used to review and validate laboratory data and final analytical results will reside with the ASPHL and their internal data validation procedures. Most samples are expected to be accepted, except for samples surpassing the 14-day holding period, samples missing their identification label, or leaking samples which will be rejected. ASPHL will report rejections and anomalies to the CLPPP manager. If needed, CLPPP will provide additional training to the contractors.

D-2 Verification and Validation Methods

The process for verification and validation of data will be determined by ASPHL's quality control procedures. ASPHL will be the dedicated location where all quality control checks regarding the raw samples will be conducted for this project. ASPHL will confirm data on the laboratory submission form and compare it to the samples received. If physical samples received match the data entered on the laboratory submission form, further processing of the samples can occur. Should data on the laboratory submission form not match up with the samples collected, ASPHL will contact the CLPPP manager for further action. After results have undergone quality control reviews, analytical data will be entered into a report generated by ASPHL for each public charter school. This report will be referred to as the laboratory report. These data will then be sent to the CLPPP data managers where a summary sheet of the data will be generated such that the public charter school will be notified of the results.

D-3 Reconciliation with User Requirements

Data obtained from this project will answer two questions:

1. If the public charter school has any water coolers that contain lead components of water coolers that match the model number on EPA's document entitled 3Ts for Reducing Lead in Drinking Water in Schools document EPA 815-B-18-007; October 2018) in Appendix B.

2. Identify the locations within the public charter school where lead in drinking water was detected. These data can then assist the public charter school with making decisions on the removal and replacement of suspected water coolers or additional corrective actions on how to reduce potential exposures to lead in drinking water. Data from the project will be analyzed for possible outliers, confounders, or anomalies based on sampling locations, building types, and geographic locations.

FIGURES:

Figure 1-1. Organization Chart

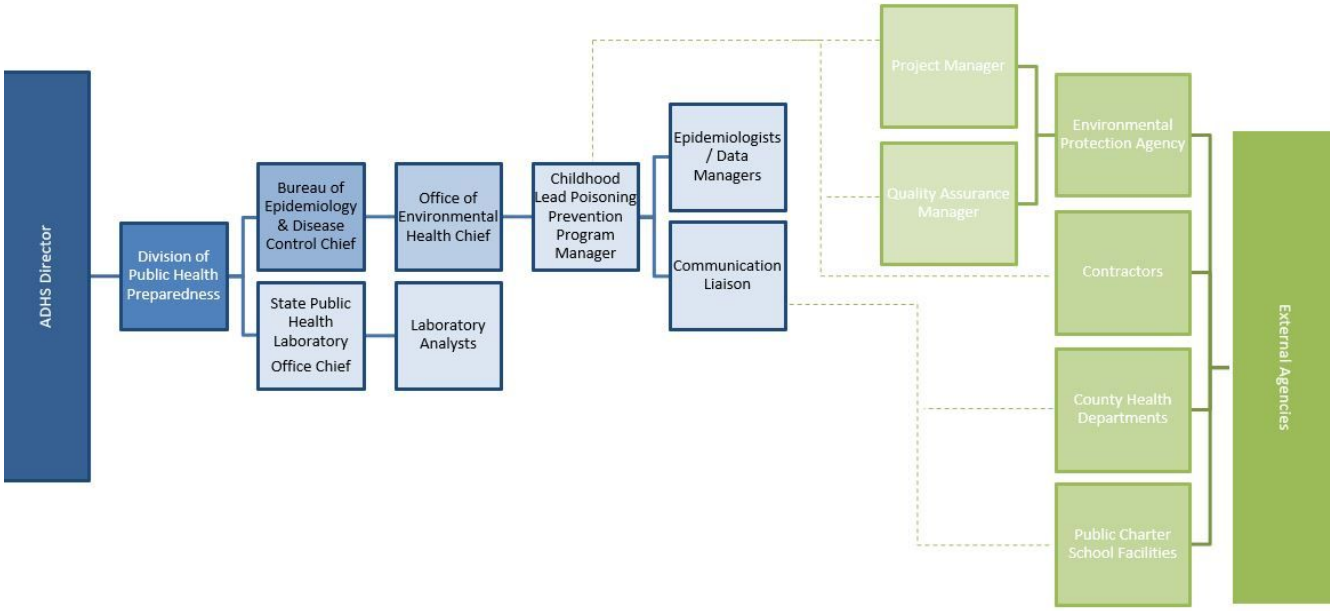
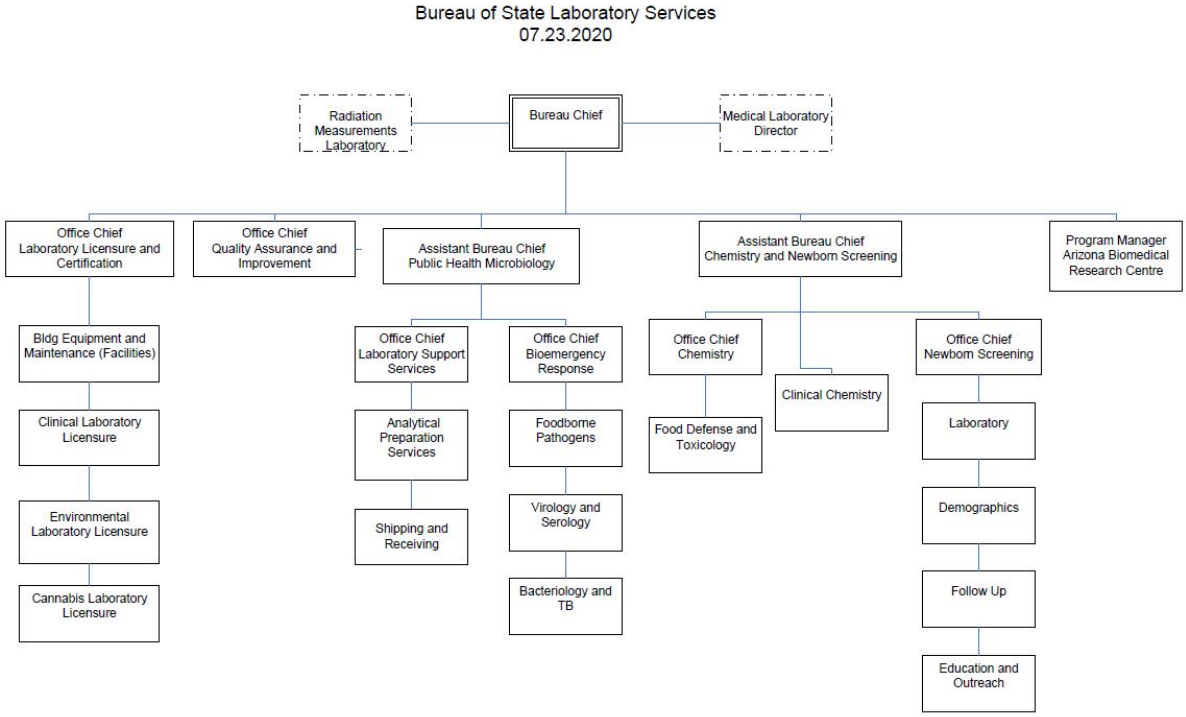


Figure 1-2. Arizona State Public Health Laboratory Organization Chart



APPENDICES

APPENDIX A. EPA's 3Ts Guidance: Two Sampling Method

APPENDIX B. 3Ts for Reducing Lead in Drinking Water in Schools, *Lead Coolers Banned in 1988* (EPA 815-B-18-007)

APPENDIX C. Arizona State Public Health Laboratory Quality Assurance Manual

APPENDIX D. Notification of Action Level Exceedance

APPENDIX E. Sampling plan

APPENDIX F. Sampling Schedule

APPENDIX G. Field Sampling Log

APPENDIX H. Sample Labels

APPENDIX I. Laboratory Chemistry Sample Submission Form

APPENDIX J. EPA 200.8 BLS-282 Standard Operating Procedure

Appendix A: EPA's 3Ts Guidance Two-Step Sampling Method

Module 5: Conducting Sampling and Interpreting Results

2-Step Sampling at the Tap

Communication Plan: Don't forget to communicate your plans to test your facility, and to prepare for communicating results. Results should be shared regardless of the lead level detected.

2-Step Sampling at the Tap

EPA recommends that schools and child care facilities conduct a 2-step sampling procedure to identify if there is lead in the outlet (e.g., faucet, fixture, or water fountain) or behind the wall (e.g., in the interior plumbing). These samples should be taken after an 8 to 18-hour stagnation period.

Please note that this section contains recommendations that are generalized for typical plumbing configurations. The **Detailed Fixture Evaluation** contains details on types of fixtures and targeted sampling.

STEP 1

250-mL First Draw Sample

Take a 250mL first draw sample at all taps used for consumption to identify potential lead in the fixture.

STEP 2

250-mL Flush Sample

If the result of Step 1 is high, take a 30-second flush sample to identify lead in the plumbing behind the fixture.

These samples can be taken in the same sampling event, which can reduce cost, and provide you with more information on lead levels. If not taking these samples at the same time, and elevated lead levels have been found in Step 1, the water should not be consumed while preparing to take the follow-up flush sample. More information on immediate steps is in **Module 6**.

Helpful Tip…

For further potential cost savings, you or the lab can collect, preserve, and hold (but not analyze) the second sample at the same time the first sample is collected, then analyze only selected Step 2 samples based on review of the Step 1 results. Most commercial labs will "Hold" samples until the client advises to dispose (at nominal cost) or analyze those samples.

EPA OFFICE OF GROUND WATER AND DRINKING WATER

Office of Water
EPA 815-F-18-022
October 2018

Step 1: Initial First Draw Samples

Take first draw samples from fixtures throughout the building that are used for human consumption. EPA strongly recommends that you collect these samples from all outlets used for drinking or cooking, prioritizing the high-risk outlets (i.e., fixtures that are known to or potentially contain lead and fixtures that are used most frequently). The plumbing profile will help pinpoint those high-risk fixtures and to prioritize sample collection.

Important: schools and child care facilities should not use sample results from one outlet to characterize potential lead exposure from all other outlets in their facility. This approach could miss localized lead problems that would not be identified.

The first draw sample identified in Step 1 is representative of the water that may be consumed at the beginning of the day or after infrequent use. This protocol maximizes the likelihood that the highest concentrations of lead will be found because the first 250-mL sample is collected after overnight stagnation (the water sat in the pipes for at least 8 hours).

Procedures for initial outlet samples are shown below:

- All samples should be collected before the facility opens and before the fixtures have been used (EPA recommends an 8 to 18-hour stagnation period).
- One 250-mL sample should be taken at each fixture. Note this is a first-draw sample. Therefore, collect the sample immediately after opening the faucet or valve.
- Compare all sample results to prioritize follow-up sampling and remediation. Outlets with elevated lead levels should not be made available for consumption.

STEP 1

250-mL First Draw Sample

Take a 250mL first draw sample at all taps used for consumption to identify potential lead in the fixture.

High Results Due to Particulate Lead

If initial first draw sampling results reveal high lead levels in the 250-mL sample for a given outlet, a contributing source of the elevated lead levels could be the debris in the aerator or screen of the outlet. By cleaning the aerator or screen and retesting the water following the initial first draw sampling procedures, you can identify whether or not the debris is contributing to elevated lead levels.

Determining aerator/screen debris contribution:

Scenario 1: The initial sample result is 19 ppb; you decide to see if the aerator is contributing to lead in the water. After cleaning out the aerator, you take another first-draw sample. The results come back less than or close to the detection level (e.g., 1 ppb). This result indicates that the debris in the aerator was likely contributing to elevated levels in the fixture. Continue to clean the aerator on a regular basis; continued use of the outlet should be acceptable. However, please note that without regular maintenance, this outlet may serve water with elevated lead levels.

Scenario 2: The initial sample result is 22 ppb; you decide to see if the aerator is contributing to lead in the water. After cleaning out the aerator, you take another first-draw sample. The second sample result is very close or equivalent to the 22-ppb sample. Since the initial sample and post-cleaning first-draw sample results are similar, the problem is likely not the aerator.

Scenario 3: The initial first draw sample result is 60 ppb; you decide to see if the aerator is contributing to lead in the water. After cleaning the aerator, you take another first-draw sample. The post-cleaning sample result is 25 ppb. Although the results are lower, they are still high; this indicates that the aerator is likely a contributing source and that the outlet itself and/or the plumbing upstream of the aerator are contributing as well. If this situation occurs, the school should take this fixture offline, and continue with 2-step sampling, or consider the Detailed Fixture Evaluation in Appendix D to target the additional contributing sources.

* When taking a second first-draw sample, please remember to follow the same sampling procedure as the initial first-draw sample. Ensure that fixtures and outlets have been out of use for 8-18 hours, sampling before students arrive at the facility.

Picture of an aerator with particulate

Step 2: Follow-Up Flush Samples

If initial test results reveal elevated lead, follow-up flush testing described in Step 2 is recommended to determine if the lead contamination results are from the fixture or from interior plumbing components. Follow-up flush samples generally involve the collection of water from an outlet where the water has run for 30 seconds.

The purpose of Step 2 is to pinpoint where lead is getting into drinking water (i.e., fixtures versus interior plumbing) so that appropriate corrective measures can be taken.

Procedures for initial outlet samples are shown below:

- As with initial first draw samples, follow-up flush samples are to be taken before a facility opens and before any water is used. For best results, flush samples from different outlets that are in close proximity should be collected on different days. For drinking fountains or other fixtures that are manifolded closely together, a single flush sample may be representative of the shared interior plumbing.
- The sampler should be careful to maintain a consistent rate of flow when collecting flush samples.
- Open up the tap and let the water run for 30 seconds. Then, take a 250mL sample. Make sure to label this sample bottle as the flush sample.

STEP 2

250-mL Flush Sample

If the result of Step 1 is high, take a 30-second flush sample to identify lead in the plumbing behind the fixture.

Sampling Dos and Don'ts

Do:

- Follow the instructions provided by the laboratory for handling sample containers to ensure accurate results.
- Assign a unique sample identification number to each sample collected. Use a coding scheme to help differentiate samples, and don't forget to label each sample bottle.
- Collect all water samples before the facility opens and before any water is used. The water should sit in the pipes unused for at least 8 hours but not more than 18 hours before a sample is taken.
- Learn how water flows in your facility. If there are multiple floors, it is typically recommended to sample from the bottom floor and continue up. Start sampling closest to the main and work away.

Don't:

- Remove aerators prior to sampling. Potential sources of lead may be missed if aerators are removed, since debris could be contributing to the lead in drinking water if particles containing lead are trapped behind aerator screens.
- Flush water prior to sampling, unless instructed to do so. Flushing can be a tool to improve water quality, especially after long holidays or weekends. However, flushing prior to sampling may cause results showing lower-than representative lead levels in the water. See **Flushing Best Practices Factsheet** for more information.
- Close the shut-off valves to prevent their use prior to sample collection. Minute amounts of scrapings from the valves can produce results showing higher-than-representative lead levels in the water.

Don't forget to maintain a record!

Recording sample information is critical to tracking and managing water quality year-over-year.

Appendix B: 3Ts for Reducing Lead in Drinking Water in Schools, Lead Coolers Banned in 1988

Appendix B: Lead Water Coolers Banned in 1988

Lead Water Coolers Banned in 1988

The Lead Contamination Control Act (LCCA), which amended the Safe Drinking Water Act (SDWA), was signed into law on October 31, 1988 (P.L. 100-572). The potential of water coolers to contribute lead to drinking water in schools and child care centers was a principal focus of this legislation. Specifically, the LCCA mandated that the Consumer Product Safety Commission (CPSC) order the repair, replacement, or recall and refund of drinking water coolers with lead-lined water tanks. In addition, the LCCA called for a ban on the manufacture or sale in interstate commerce of drinking water coolers that are not "lead-free." Civil and criminal penalties were established under the law for violations of this ban. With respect to a water cooler that may come in contact with drinking water, the LCCA (Section 1461 of SDWA) defines the term "lead-free" to mean:

not more than 8 percent lead, except that no drinking water cooler which contains any solder, flux, or storage tank interior surface which may come in contact with drinking water shall be considered "lead-free" if the solder, flux, or storage tank interior surface contains more than 0.2 percent lead.

Another component of the LCCA was the requirement that EPA publish and make available to the states a list of drinking water coolers, by brand and model, that are not "lead-free." In addition, EPA was to publish and make available to the states a separate list of the brand and model of water coolers with a lead-lined tank. EPA is required to revise and republish these lists as new information or analyses become available.

Based on responses to a Congressional survey in the winter of 1988, three major manufacturers (the Halsey Taylor Company, EBCO Manufacturing Corporation, and Sunroc Corporation) indicated that lead solder had been used in at least some models of their drinking water coolers. On April 10, 1988, EPA proposed in the Federal Register (54 FR 14320) lists of drinking water coolers with lead-lined tanks and coolers that are not "lead-free." Public comments were received on the notice, and the list was revised and published on January 18, 1990 (Part III, 55 FR 1772). See the following page for a list of water coolers and lead components included on that list.

Important Note: The 1990 list is based on a definition of "lead free" in SDWA applicable to drinking water coolers only (SDWA Section 1461). At the time it was enacted, the 8% standard of the definition was the same as the definition of lead free in another section of SDWA applicable to pipes, pipe fittings, plumbing fittings and fixtures, solder, and flux (SDWA Section 1417). Since then, however, the definition of "lead free" for pipes, fittings, and fixtures in Section 1417 was changed as a result of the 2011, **THE REDUCTION OF LEAD IN DRINKING WATER ACT** to a weighted average of 0.25 percent of the wetted surface. **It is still important to test fixtures that are not on this list; especially if they were installed prior to 2014, the year THE REDUCTION OF LEAD IN DRINKING WATER ACT became effective.**

List of Water Coolers and Lead Components

EBCO Manufacturing

All pressure bubbler water coolers with shipping dated from 1962 through 1977 have a bubbler valve containing lead. The units contain a single 50-50 tin-lead solder joint on the bubbler valve. Model numbers for coolers in this category are not available.

The following models of pressure bubbler coolers produced from 1978 through 1981 contain one 50-50 tin lead solder joint each.

CP3	DP15W	DPM8	7P	13P	DPM8H	DP15M	DP3R	DP8A
DP16M	DP5S	C10E	PX-10	DP7S	DP13SM	DP7M	DP7MH	DP7WMD
WTC10	DP13M-60	DP14M	CP10-50	CP5	CP5M	DP15MW	DP3R	DP14S
DP20-50	DP7SM	DP10X	DP13A	DP13A-50	EP10F	DP5M	DP10F	CP3H
CP3-50	DP13M	DP3RH	DP5F	CP3M	EP5F	13PL	DP8AH	DP13S
CP10	DP20	DP12N	DP7WM	DP14A-50/60				

Halsey Taylor

Lead solder was used in these models of water coolers manufactured between 1978 and the last week of 1987:

WMA-1	SCWT/SCWT-a	SWA-1	DC/DHC-1
S3/5/10D	BFC-4F/7F/4FS/7FS	S300/500/100D	

The following coolers manufactured for Haws Drinking Faucet Company (Haws) by Halsey Taylor from November 1984 through December 18, 1987, are not lead-free because they contain 2 tin-lead solder joints. The model designation for these unites are as follows:

HC8WT	HC14F	HC6W	HWC7D	HC8WTH	HC14FH	HC8W	HC2F	HC14WT
HC14FL	HC14W	HC2FH	HC14WTH	HC8FL	HC4F	HC5F	HC14WL	HCBF7F
HC4FH	HC10F	HC16WT	HCBF7HO	HC8F	HC8FH	HC4W	HWCZ	

Lead Lined Tanks

Prior to publication of the January 1990 list, EPA determined that Halsey Taylor was the only manufacturer of water coolers with lead-lined tanks Below provides a listing of model numbers of the Halsey Taylor drinking water coolers with lead-lined tanks that had been identified by EPA as of January 18, 1990.

Based upon an analysis of 22 water coolers at a U.S. Navy facility and subsequent data obtained by EPA, EPA believes the most serious cooler contamination problems are associated with water coolers that have lead-lined tanks.

Since the LCCA required the CPSC to order manufacturers of coolers with lead-lined tanks to repair, replace, or recall and provide a refund of such coolers, the CPSC negotiated such an agreement with Halsey Taylor through a consent order published on June 1, 1990 (at 55 FR 22387). The consent agreement calls on Halsey Taylor to provide a replacement or refund program that addresses all the water coolers listed below as well as "all tank-type models of drinking water coolers manufactured by Halsey Taylor, whether or not those models are included on the present or on a future EPA list." Under the consent order, Halsey Taylor agreed to notify the public of the replacement and refund program for all tank type models.

Currently, a company formerly associated with Halsey Taylor, Scotsman Ice Systems, has assumed responsibility for replacement of lead-lined coolers previously marketed by Halsey Taylor. If a school or child care facility has one of the Halsey Taylor water coolers noted below, contact Scotsman Ice Systems to learn more about the requirements surrounding its replacement and rebate program.

Scotsman Ice Systems

775 Corporate Woods Parkway Vernon Hills, IL 60061

PH: (800) SCOTSMAN or 800-726-8762

PH: (847) 215-4500

Halsey Taylor Water Coolers with Lead-Lined Tanks

The following six model numbers have one or more units in the model series with lead-lined tanks:

WM8A	WT8A	GC10ACR	GC10A	GC5A	RWM13A

The following models and serial numbers contain lead-lined tanks:

WM14A Serial No. 843034	WM14A Serial No. 843006	WT11A Serial No. 222650
WT21A Serial No. 64309550	WT21A Serial No. 64309642	LL14A Serial No. 64346908

Appendix C: Arizona State Public Health Laboratory Quality Assurance Manual

Arizona State Public Health Laboratory

Quality Assurance Manual

Non-Clinical

August 2020
Revision #21

TABLE OF CONTENTS PAGE

1.0 INTRODUCTION

The Arizona State Public Health Laboratory's (ASPHL) quality program encompasses quality assurance, quality control, and quality improvement. The quality program covers the testing performed at the primary location, 250 N. 17th Avenue, Phoenix, Arizona 85007, and at the secondary location, Radiation Measurements Laboratory (RML), located at 4814 S. 40th Street, Phoenix, Arizona 85040. These are components of a multi-faceted effort from sample plans to final reports. Quality is involved in the strategic planning, ongoing assessment, and evaluation of the process, to identify, monitor, and manage the potential error that may enter the process. The approach establishes and applies a verifiable management plan, which actively implements the tactics and procedures necessary to ensure production of known quality data.

This plan, in concert with respective Standard Operating Procedures (SOP), various regulatory and non-regulatory documents, and the International Organization of Standardization (ISO)/ International Electrochemical Commission (IEC) 17025 standard (*General Requirements for the Competence of Testing and Calibration Laboratories)*, describes the processes used by the ASPHL to ensure quality data. Thus, the primary objective of these procedures has been to establish the protocols for recording of laboratory activities and associated quality procedures; accompanied by records that can trace possession of a sample from time of collection through utilization of the results for preparation of reports.

This manual covers non-clinical work performed by ASPHL staff for entities such as the Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention (CDC), the US Food and Drug Administration (FDA), the United States Nuclear Regulatory Commission (NRC), and others as requested.

ASPHL's top management is committed to ensuring the quality of the work performed and through the various procedures, policies, and processes in place demonstrates their commitment. The top management shall ensure that staff follows good laboratory practices through training programs and opportunities for improvement. In addition, management shall ensure that staff maintains professionalism when interacting with customers, whether internal or external.

2.0 QUALITY ASSURANCE SUMMARY

Quality assurance starts with planning before sampling begins. It includes providing clients with training in field activities intended to ensure a basic understanding of theoretical and practical planning aspects of sampling needed to ensure collection of appropriate samples for the desired end use. The ASPHL staff are often consulted regarding sampling protocols and provide information to clients in the ASPHL *Guide to Laboratory Services*. This technical advice may include proper collection and preservation techniques, sample transport, or type of test to be performed along with the data quality objectives the clients need. If a client does not specify any quality assurance objectives, the laboratory will follow the established regulatory and internal procedures and policies.

The quality assurance and quality control protocols for the analyses performed by the ASPHL are derived from a number of references. The basic principles are based upon the requirements of

the customers and regulatory authorities, including but not limited to the EPA guidelines and requirements as well as requirements established by the FDA, CDC, ISO/IEC 17025 standard, and accreditation body requirements and guidelines for specific testing specialties such as forensic toxicology. Thus the quality program must include not only a written plan but the successful participation of unknown proficiency samples for testing performed, proper documentation and records of analytical methodologies, matrix effects, instrument maintenance, and internal and external inspections. Data produced by the ASPHL staff are peer-reviewed before a final report or data package is issued to the client.

As part of the quality assurance program, the laboratory encourages a process of continual improvement. ASPHL reviews corrective actions, plans for future actions, and works with staff to encourage improving the overall system to provide quality testing results.

Procedures, plans, forms, and other documents related to the quality management (assurance) program can be found on the Document Control SharePoint site.

3.0 CONTROL AND REVISION OF THE QUALITY ASSURANCE MANUAL

The Quality Assurance Manual is reviewed annually and any changes needed are considered against the basic quality objectives prior to being implemented. The plan is then approved by the Laboratory Director and Quality Assurance Manager. Distribution is performed per SOP QA-024, Document Control.

4.0 MANAGEMENT REQUIREMENTS

4.1 PROGRAM ORGANIZATION

The Arizona State Public Health Laboratory (ASPHL) and the secondary location, Radiation Measurement Laboratory (RML) are part of the Arizona Department of Health Services. The laboratory is authorized to perform testing under Arizona Revised Statute (A.R.S.) § 36-251, State Laboratory. The ASPHL shall examine and analyze such foods, water supplies, drugs, and other specimens as the director of the Department of Health Services directs. The Bureau Chief, per A.R.S. § 36-253, may make provisions or issue directions for taking and forwarding samples of potable waters, and perishable foods and drinks, and shall perform the duties prescribed by law and by the director of the Department of Health Services. The director, per A.R.S. § 30-654, may request the laboratory to conduct radiological environmental monitoring of the air, water and soil surrounding any fixed nuclear facility, any uranium milling and tailing site and any uranium leaching operation, and maintain and report the data or results obtained by the monitoring as deemed appropriate.

The ASPHL is under the supervision of a Bureau Chief (non-clinical Laboratory Director) who is appointed by the director of the Department of Health Services.

This plan covers **non-clinical work** performed by ASPHL staff for entities such as the EPA, the CDC, the FDA, the NRC, and others as requested. In order to satisfy the needs of the customers and regulatory authorities, the ASPHL performs tests within its scope, including but not limited to the following guidelines:

- EPA Manual for the Certification of Laboratories Analyzing Drinking Water
- FDA Food Emergency Response Network (FERN)
- ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories

The ASPHL's management system covers work carried out in the laboratory's facilities located at 250 N. 17th Avenue, Phoenix, Arizona, 85007 and at 4814 S. 40th Street, Phoenix, Arizona, 85040. The testing performed under this Quality Assurance Manual occurs only at these facilities.

Department employees must adhere to statutes, internal policies regarding ethics, standards of conduct, and conflict of interest, and accreditation body requirements. These include the following which are reviewed with staff annually:

- A.R.S. § 38-501 through 38-510, Public Officers and Employees
- State Personnel System, Employee Handbook
- Arizona Department of Health Services (ADHS), Ethics Policy 008-2015
- Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel

The managerial and technical personnel have the authority and resources needed to carry out their duties, including the implementation, maintenance and improvement of the management system and testing procedures. This includes identifying departures from the management system or from procedures for performing tests and to initiate actions to prevent or minimize such departures. Refer to SOP QA-016, Root Cause Analysis and Corrective Action Instructions.

ASPHL has arrangements to ensure that its management and personnel are free from any undue internal and external commercial, financial, and other pressures and influences that may adversely affect the quality of their work. Refer to A.R.S. § 38-501 through 38-510, the State Personnel System, Employee Handbook, and ADHS Ethics Policy 008-2015.

ASPHL ensures the protections of its customers' confidential information, and has procedures for protecting the electronic storage and transmission of results. Refer to Arizona Department of Health Services Information Technology Services (ITS) documents including: Acceptable Use HS100, Confidentiality Policy HS104 and Information Security Program ITS102, which includes information on confidentiality and Health Insurance Portability and Accountability Act (HIPAA). The laboratory compliance officer is notified any time a potential breach of confidential information has occurred.

ASPHL avoids involvement in any activities that would diminish confidence in its competence, impartiality, judgment, or operational integrity. A documented annual review of the current published version of *PR 3150 Guiding Principles of Professional Responsibility for Forensic Service Providers and Forensic Personnel* is provided to individuals involved in the Forensic Toxicology program. An equivalent document that covers the same topics and demonstrates that relevant aspects are covered may be used instead of PR3150. Refer to the State Personnel

System, Employee Handbook, and A.R.S. § 38-501 through 38-510 for additional information and actions that may be taken.

An organizational chart reflects the relationships between quality management, technical operations, support services, and authority within the laboratory (Appendix A). Quality assurance, recognized as a major function, is integrated throughout the operations.

Responsibilities are assigned so that the work can be carried out accurately at all levels and are outlined in the personnel description (PD) or job description for the various positions within the laboratory. The PD or job description is accessible by staff through their supervisor or through human resources.

Adequate supervision shall be provided in each area of the laboratory for all personnel by persons familiar with the test methods and procedures. All results shall be reviewed by personnel before release.

The ASPHL shall be under the supervision of a Bureau Chief (non-clinical Laboratory Director) who is appointed by the director of the Department of Health Services. This position has overall responsibility for the technical operations and provision of necessary resources to ensure the quality of laboratory operations and compliance with required standards. The Bureau Chief is responsible for planning, developing, organizing, directing, and evaluating the testing capabilities and capacity of the ASPHL. The Bureau Chief is also responsible for ensuring that management reviews are performed on a routine basis. The Bureau Chief delegates some of the responsibility for planning, developing, organizing, directing, and evaluating diagnostic, analytical, regulatory, and consultative services provided by ASPHL to the Assistant Bureau Chiefs. Responsibility is further delegated to the Office Chiefs, under the Assistant Bureau Chiefs, for day to day operations of the various testing programs the ASPHL provides.

The Quality Assurance (QA) Manager is independent of the analytical testing sections and reports directly to the Bureau Chief. The Bureau Chief has delegated to the QA Manager oversight of the quality assurance program and signatory authority for the majority of the procedures, policies, and other activities related to the program. The QA Manager is also responsible for the following:

- Ensuring that a quality management (assurance) program is in place, followed, and reviewed, and assisting with:
    - Management reviews
    - Monitoring trainings
    - Reviewing procedures, policies, and plans
    - Proficiency samples, round robins, and accuracy checks
- Planning and organizing internal audits as required by schedule and requested by management, and performed by qualified individuals
- Ensuring compliance with the various regulatory, standard, and guidance requirements. Some of these the laboratory follows include:

- EPA Manual for the Certification of Laboratories Analyzing Drinking Water
- FDA Food Emergency Response Network
- ISO/IEC 17025 Standard
- AR 3125, Forensic Science Testing and Calibration Laboratories: Accreditation Requirements

The QA Manager delegates to the QA Officers the responsibilities of monitoring and reviewing the quality management program, internal audits, and compliance review.

Within the ASPHL, the technical management authority rests with the Microbiology and Chemistry Chiefs. The Microbiology and Chemistry Chiefs may delegate their technical management responsibilities to an appropriate unit supervisor.

Employees are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system through staff emails, meetings, management reviews and reports, feedback, and audit findings.

The ASPHL Management and QA Unit ensure that appropriate communication processes are established, that communication takes place regarding the effectiveness of the management system, and that the integrity of the quality system is maintained when changes are planned and implemented.

4.2 MANAGEMENT SYSTEM

The ASPHL established, implemented and maintains a management system supporting the testing conducted by the laboratory under its quality system. The management system is described in this quality manual and the documents it references. These documents are readily available to all laboratory staff through the Document Control System (DCS) and section QA binders and serve as the basis for evaluating the integrity of tests and associated reports. It is the responsibility of all laboratory staff to read this manual and any applicable associated documents, and to implement and follow the quality management program. It is also the staff's responsibility to assist in improving the overall laboratory program.

The **ASPHL Quality Policy Statement** is issued under the authority of the Bureau Chief and the Quality Assurance Manager through their signatures on the cover page of this manual with input from the management team. The ASPHL management team is committed to providing good professional practice, ensuring impartiality and confidentiality practices are in place and implemented, and providing quality testing services to its customers, continually improving the effectiveness of the management system, and adhering to requirements, including EPA and ISO/IEC 17025 where applicable. The quality practices outlined in this manual serve to guide the laboratory staff in the performance of good laboratory practices and the production of quality results, and to carry out tests in accordance with stated methods and customer requirements. All laboratory personnel are required to familiarize themselves with the management system and its documentation, and to adhere to the policies and procedures that comprise the quality system.

Quality Objectives are reviewed and discussed during Management Review meetings. ASPHL's

quality objectives include the following:

- To provide reliable, efficient analytical services in support of several programs including, but not limited to, environmental and food analysis for microbiological and chemical contaminants.
- To ensure customer service and satisfaction.
- To ensure a quality system that provides quality products and services.
- To continue quality improvement through employee involvement.
- To maintain compliance for applicable areas with EPA and ISO/IEC 17025.

Top management demonstrates commitment to the development and implementation of the management system and to continually improving its effectiveness through management reviews, dedication of resources, and communication to employees. They also ensure the integrity of the management system when changes to the management system are planned and implemented. See SOP QA-035, Management Reviews.

Top management communicates the importance of meeting customer as well as statutory and regulatory requirements through staff meetings, emails, and training.

This quality manual includes or references supporting and technical procedures. The QA Unit maintains a master list of documents and procedures related to this quality manual. The documents related to the quality system are primarily stored in the Document Control System and in section document and procedure binders. The structure of documentation used in the management system can be found in SOPs QA-019, Preparation and Modification of Internal Documents, QA-024, Document Control, and QA-036, Preparation and Modification of Internal Laboratory Documents for the Microbiology Office Section.

Roles, Responsibilities, and Authority in the Laboratory

The responsibility of maintaining compliance with the quality assurance program within the laboratory belongs to the Section Supervisor and their staff.

Section Supervisors have the following duties:

- Training laboratory personnel in all aspects of analysis and safety policies as well as encouraging technical and professional staff to participate in external training and the reading of professional journals and texts. The Office Chiefs are ultimately responsible for the training of all personnel in their areas and the Section Supervisors perform or oversee the actual bench training. No one may train other personnel without first consulting the appropriate Section Supervisor.

  Training of personnel is accomplished in the following manner:

  - Direct supervision by senior scientists or Section Supervisor;
  - On the job training with intermittent assistance from experienced staff;

- Enrollment in seminars or courses sponsored by the EPA, an ISO accreditation body, federal regulatory agencies, area colleges, or other professional organizations;
- Attendance at courses held by various instrumentation manufacturers;
- Reading and studying established methods;
- Making available various standard texts and audio-visual aids in-house;
- Encouraging continuing education through a tuition reimbursement program for all personnel, as funds are available;
- Encouraging technical personnel to avail themselves of the technical journals circulated to keep current on new sampling and analysis technology. The Arizona State Public Health Laboratory (ASPHL) has a small reference library on analytical chemistry, microbiology and molecular testing and related topics and the agency has a digital library for staff; and

- Verifying any training received. All training received by the staff while at the ASPHL is documented in that individual's training file. This training file documents what training was received and how long the training lasted. This includes attendance at seminars, workshops, conferences, in-house or college courses.
- Monitoring the quality assurance activities of their section to ensure conformance with authorized policies, procedures, and sound practices plus recommending improvements as may be necessary;
- Seeking and evaluating new ideas in the field of quality assurance and quality improvement and recommending means for their application;
- Establishing testing batches;
- Approving all laboratory data, themselves or through approved designees, prior to reporting or transmitting to permanent storage;
- Reviewing standard operating procedures;
- Ensuring that sampling and other handling procedures are adequate for the sample types received;
- Overseeing the quality of purchased laboratory materials, reagents, and chemicals to ensure that these supplies do not jeopardize the quality of analytical results;
- Developing and administering a schedule of instrument maintenance;
- Scheduling the workload in each section; and
- Troubleshooting and responding to client complaints. Investigations into complaints vary with the situation. All complaints are investigated thoroughly and a review of each complaint results in the proposal, documentation and implementation of a solution. A follow-up review of the solution is made to assure the immediate and long-term effectiveness of that solution. At a minimum, laboratory sub-sampling, sample identification, and routine quality control parameters (e.g., calculations, spike recovery, etc.) are reviewed. Additional corrective action information can be found in SOP QA-

016, Root Cause Analysis and Corrective Action Instructions.

The Office Chief has the authority and responsibility for:

- Program budget and expenditures,
- Schedule of deliverables,
- Allocation of staff resources,
- Technical direction of all assigned staff members,
- ASPHL/client management and technical interfaces.

The responsibilities and duties of the Quality Assurance Manager or designee include:

- Assisting in the development and maintenance of comprehensive quality assurance and quality improvement programs that ensure the integrity of analytical results;
- Ensuring that quality assurance mandates and recommendations from the EPA, FDA, CDC, ISO/IEC 17025 accreditation body, and Occupational Safety and Health Administration (OSHA) are incorporated into ASPHL programs by maintaining close working relationships with laboratory managers and the regulatory programs;
- Monitoring selected raw data, laboratory reports and performance on all proficiency test samples;
- Reviewing corrective actions for problems identified during routine analyses, by internal and external proficiency programs, with the Section Supervisors and the Office Chiefs;
- Performing internal audits of individual working units and sections of the ASPHL;
- Conducting periodic reviews of laboratory reports to ensure compliance with internal quality assurance requirements;
- Performing periodic reviews of the employees' training files to ensure they are kept up to date and that all training is properly documented.

4.3 DOCUMENT CONTROL

The ASPHL manages all documents that form part of its management system (internally generated or from external sources), such as regulations, standards, other normative documents, test and/or methods, as well as drawings, software, specifications, instructions, and manuals and can be found on the Document Control site or a specified section in the laboratory and a list provided when requested by the Quality Assurance unit.

Document Approval and Issue

All documents issued to personnel in the laboratory as part of the management system are reviewed and approved for adequacy and for use by authorized personnel prior to issue. See SOP QA-024, Document Control. The QA Unit maintains a master list that identifies the current revision status and distribution of controlled documents in the management system.

The document procedures (QA-024, Document Control; QA-019, Preparation and Modification of Internal Documents, and QA-036, Preparation and Modification of Internal Laboratory Documents for the Microbiology Office Section) ensure that:

- Authorized editions of appropriate documents are available where operations essential to the effective functioning of the laboratory are performed;
- Documents are periodically reviewed and, where necessary, revised to ensure continuing suitability and compliance with applicable requirements.
- Invalid or obsolete documents are promptly removed from all points of issue or use, and are suitably marked.

Internally generated documents are uniquely identified and include the date of issue, page numbering, the total number of pages, and issuing authority/authorities.

Document changes are reviewed and approved for adequacy by the same function that performed the original review unless specifically designated otherwise. See SOP QA-019, Preparation and Modification of Internal Documents, QA-036, Preparation and Modification of Internal Laboratory Documents for the Microbiology Office Section and QA-024, Document Control, for specific instructions, including changes in documents maintained in computerized systems and their control. Personnel have access to pertinent background information upon which to base their review and approval.

4.4 REVIEW OF REQUESTS, TENDERS, AND CONTRACTS

The ASPHL follows the established procedures for the review of requests, tenders, and contracts set forth by the Arizona Department of Health Services, Procurement Office. The Procurement Office issues notices to ASPHL when a current contract is due for review and the staff review and determine next steps with the Procurement Office. If a new service is needed, the ASPHL initiates a discussion with the Procurement Office. Procedures related to the Procurement Office can be located on the intranet site at http://intranet.hs.azdhs.gov/forms-policies/procurement.

Samples may be submitted to the ASPHL from state, local, and federal agencies or on behalf of these agencies for routine, surveillance, reference, and emergency response testing. Prior to receiving samples, ASPHL will work with clients to develop a project work plan. Project work plans may be found in grant submissions, memorandums of understanding (MOU), interagency agreements, contracts, submission forms, or other forms of communication. Any changes made to the project work plan will be discussed with the client prior to implementing the change and will be recorded.

Project work plans should include the purpose of the project, period of performance, the length of the project, resources needed for the project, listing of testing options, and any special requirements that may be requested. In addition, the plans will note that reports or data packages will be provided to the client within the confines of proper quality control and review. ASPHL has a review process in place to ensure that project work plans are complete. If a client does not specify any quality assurance objectives, the laboratory will follow the established regulatory and internal procedures and policies. ASPHL follows A.R.S. Title 39 – Public Records, Printing and Notices and where required follows state and federal regulations for providing results for

public health purposes.

ASPHL acknowledges and encourages clients to submit their own quality control checks or blind samples to verify the laboratory's quality program.

Clients are given access to the *Guide to Laboratory Services* which includes information related to tests available, shipping requirements, and sampling requirements. Specific client requirements for the handling of samples will be discussed with the client prior to implementation and will be recorded outside the *Guide to Laboratory Services* and this manual. For clients requesting chain of custody, information about ASPHL's process can be found in the *Guide to Laboratory Services*.

ASPHL follows official methodologies for testing whenever possible from regulatory or nationally recognized sources, such as national laboratory networks or peer reviewed journals. The laboratory incorporates sufficient quality control measures in the procedures used for testing based on the methods, regulations, standards, and recognized good laboratory practices. In addition, the laboratory will incorporate client specific measures when requested and provided in project work plans. If there is no official methodology from any source, the ASPHL will work with the client on method development in order to perform the needed testing.

Records of reviews, including significant changes are maintained, including discussions with the customer relating to the customer requirements or results of the work during the contract period, and include subcontracted work. Any changes to the work will undergo the same process.

4.5 SUBCONTRACTING OF TESTS

The laboratory does not routinely subcontract out analysis. If for any reason the laboratory has to subcontract work for which it is accredited, a competent subcontracting laboratory will be chosen to perform the work or will be a laboratory of the customer's specifications. The subcontracting laboratory will either be accredited to the tests performed or will meet applicable statutory or regulatory requirements for performing the tests, or will be determined to be competent to do the work. The QA Unit will perform a review of laboratory accreditations of subcontracting laboratories, and track accordingly.

The laboratory will notify the customer when an analysis needs to be subcontracted, and where appropriate, obtain approval from the customer before proceeding. In the event the customer requests submittal of samples to another laboratory, the sample is submitted to the designated laboratory. Work performed by a subcontracting laboratory is identified on the final report.

The laboratory is responsible for the analyses performed by a subcontracting laboratory, except when the customer specifies which subcontractor shall be used.

If the laboratory were to subcontract, a list of subcontractors used for testing would be available. For subcontracted testing performed under the laboratory's scope of accreditation, the information about the contractor includes evidence of their accreditation. The QA Unit will work with the laboratory sections to generate a list at least yearly.

4.6 PURCHASING SERVICES AND SUPPLIES

The ASPHL staff follow the Document Request System User Manual maintained by ADHS Finance and/ or Purchasing staff, for the purchasing of reagents, consumables, and other supplies and services related to testing and processing performed by the laboratory. The procedure provides instructions on completing the purchase request form, technical review, approval of orders and receipt of items. The evaluation of suppliers of critical consumables, supplies, and services which impact the quality of testing is performed periodically using the packing slips and the Document Request System for purchasing. The evaluation will include a review of the Vendor Contact List.

4.7 SERVICE TO THE CUSTOMER

The laboratory is willing to cooperate with customers in clarifying their requests and in monitoring the laboratory performance in relation to the work performed, while ensuring confidentiality to other customers. Communication occurs, and customers are notified of any significant delays or major deviations.

The laboratory seeks feedback, both positive and negative, from its customers by means of meetings, laboratory reviews, correspondence, and surveys. Information gathered will be analyzed and used to improve the management system, testing activities and customer service. Feedback is covered during the management review and other regularly scheduled management meetings.

4.8 COMPLAINTS

The laboratory will ensure that internal and external complaints will be investigated, documented, and resolved in a timely manner. Records shall be maintained for all complaints, the investigation and corrective actions taken by the laboratory.

Customer complaints received by the laboratory shall be resolved through a corrective action procedure according to SOP QA-016, Root Cause Analysis and Corrective Action Instructions.

4.9 CONTROL OF NONCONFORMING TESTING AND/OR WORK

Identified nonconforming work, such as testing discrepancies, proficiency test sample problems, departures from quality system policies and procedures, audit findings, departures from customer requirements or other related problems shall be controlled and managed following SOP QA-016, Root Cause Analysis and Corrective Action Instructions. A correction is taken immediately, along with an evaluation and decision about the acceptability of the nonconforming work based on the risk levels established by management.

All staff have the authority to halt their work when a nonconformance is identified and are responsible for notifying their supervisor or the QA Unit when they occur. The supervisor has the authority to stop work and/or withhold testing results and is responsible for notifying the customer when required or work is necessary to be recalled. The supervisor has the authority to allow the resumption of work and/or release of testing results.

Where the evaluation, based on the risk levels, indicates that the nonconforming work could recur or if there is doubt about the compliance of the laboratory's operations with its own policies and procedures, the corrective action process will be followed as per SOP QA-016, Root Cause Analysis and Corrective Action Instructions.

4.10 IMPROVEMENT

The laboratory will continually improve the effectiveness of its management system through the use of the quality policy, quality objectives, feedback from customers and staff, audit results, analysis of data, corrective actions and management review. The ASPHL also uses the Arizona Management System (AMS) to improve its processes.

4.11 CORRECTIVE ACTION

Corrective action is implemented per SOP QA-016, Root Cause Analysis and Corrective Action Instructions, when nonconforming work or departures from the policies and procedures in the management system or technical operations have been identified. Problems may be identified through a variety of ways including audits, management reviews, customer complaints, or staff observations.

The procedure for corrective action starts with an investigation to determine the root cause(s) of the problem. Potential causes could include customer requirements, the samples, sample specification, methods and procedures, staff skills, staff training, consumables, equipment, and equipment calibration.

Where corrective action is needed, the responsible personnel identify potential corrective actions. They select and implement the action(s) most likely to eliminate the problem and to prevent recurrence. Any corrective action identified is documented and implemented to help ensure proper resolution to the problem.

The results are monitored to ensure that the corrective actions have been effective.

The laboratory ensures that any nonconformance or departure that cause doubt on the laboratory's compliance with its own policies and procedures, or its compliance with EPA or ISO/IEC 17025 (i.e. identification of serious issues or risk to the business), are reviewed though the internal audit process using SOP QA-020, Internal and External Audits, as soon as possible.

4.12 RISKS AND OPPORTUNITIES

The ASPHL employs a proactive process that identifies needed improvements and potential sources of non-conformances, either technical or quality issues concerning the management system, through staff meetings, regular review of operational procedures, records, report data and trend analysis. Each employee is responsible for informing their supervisor when they have suggestions for improving procedures within the laboratory that may help prevent a problem from occurring. When improvement opportunities are identified action plans are developed that take into consideration risks, management goals, and objectives, implemented and monitored to reduce the likelihood of nonconformances and take advantage of improvement opportunities.

The ASPHL ensures that any action taken or improvement was effective through the use of the agency Arizona Management System.

4.13 CONTROL OF RECORDS

The laboratory has established and maintains procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. Quality records shall include reports from internal audits and management reviews as well as records of corrective actions. ASPHL has established and follows the Records Retention Policy and Schedule with the Arizona State Library, Archives and Public Records (CS 1006), and the policy follows federal guidelines as set forth by regulatory entities or by specific agreements with customers. http://www.azlibrary.gov/arm/retention-schedules. Form FQA-078 is a reference document for the respective Arizona State Library Archives & Public Records website links specific to the ASPHL records.

All records shall be legible, stored and retained in such a way that they are easily retrievable and in a suitable environment that provides protection from damage, deterioration and/or loss. Retention times of records are established that are consistent with customer and laboratory requirements.

Records are stored onsite anywhere from six months or longer depending on specific program requirements. If records are stored offsite, they are moved to the state government records retention center for a specified period. The records retention center is a secure facility and records are available from the center within 24 hours of a request. After the specified program required retention, the records are destroyed. For some programs, electronic records are required to be maintained from instruments and LIMS. These records are maintained on backup systems for the required time frame before being destroyed.

All records shall be held secure and in confidence.

Electronic records shall be protected and backed-up to prevent unauthorized access or amendment. Refer to Acceptable Use HS100, Confidentiality Policy HS104 and Information Security ITS102.

The laboratory retains records of original observations, derived data, opinions and interpretations, where applicable, and sufficient information to establish an audit trail, calibration records and identify testing personnel for each analysis performed for a defined period. Observations, data and calculations are recorded at the time they are made and are identifiable with a specific task. Sticky notes are not considered acceptable for recording original observations or derived data. When abbreviations or symbols specific to ASPHL are used, the meaning of these shall be defined in appropriate documents. Arrows, ditto marks, or equivalent notations depicting the same recording on the same document are not acceptable.

When mistakes occur in records, each mistake is crossed out and the correct value entered alongside, initialed and dated by the person making the correction. If an observation, data, or calculation is altered or rejected, the reason, the individual's initials, and the date performed shall be recorded with the data (e.g. worksheet, logbook, data packet).

If an adjustment or repair is performed on an instrument or equipment due to a calibration that does not meet criteria, pre and post adjustment/repair information shall be retained with the instrument or equipment records (e.g. logbooks, worksheets, etc.).

Electronic data are safeguarded by access, rights, and audit trail (recording changes made in the database). Electronic reports are stored in a computer system with limited access, governed by Arizona Department of Health Services information technology (IT) procedures, which follow statewide policies. The state and agency IT divisions maintain secured storage of electronic records.

4.14 INTERNAL AUDITS

The ASPHL conducts internal audits of its activities to verify its operations continue to comply with the requirements of the management system, EPA, and ISO/IEC 17025. The audits address all elements of the management system, and are carried out by trained and qualified personnel. If audit findings cast doubt on the effectiveness of operations or on test results, the laboratory would take timely corrective action and notify the customers in writing if laboratory results may have been affected. Refer to SOP QA-020, Internal and External Audits.

4.15 MANAGEMENT REVIEWS

In accordance with a pre-determined schedule and procedure, the laboratory's senior management periodically conducts a review of the laboratory's management system and testing activities to ensure their continuing suitability and effectiveness, and to introduce necessary changes or improvements.

The inputs and outputs to the management review are recorded and provided to attendees. Management ensures that actions identified during the review are carried out within an appropriate and agreed timeframe. See SOP QA-035, Management Reviews.

5.0 TECHNICAL REQUIREMENTS

5.1 GENERAL

The ASPHL management system has developed technical requirements of its management system with the understanding that numerous factors contribute to the correctness and reliability of the tests it performs.

The laboratory has taken into account those factors that may influence the reliability of results when developing test methods and procedures, in the training and qualification of personnel and in the selection and calibration/verification of equipment and instruments.

5.2 PERSONNEL

Laboratory management ensures the competency of personnel who operate specific equipment, perform methods and calibrations, evaluate results, sign test reports and ensures training programs are relevant to the present and anticipated tasks of sections. Staff includes: ADHS employees, contractors, fellows or interns.

Personnel who are undergoing training or competency assessment will have appropriate supervision. Personnel performing specific tasks shall be qualified on the basis of appropriate education, training, experience and demonstrated skills.

Training is provided by the laboratory or outside opportunities. Training needs of individual staff are identified and training plans developed to ensure competency per this manual and the Arizona State Public Health Laboratory Training Policy for present and anticipated tasks of the laboratory. Training effectiveness and demonstrated competence is evaluated and monitored continually based on quality control samples, previously tested samples and proficiency testing results. Employees in training are not authorized to conduct methods independently or to evaluate and review results, and shall be supervised appropriately. See GEN-019 and CHEM-002.

Primarily personnel providing testing are employed by the laboratory. The laboratory provides adequate supervision to maintain staff compliance with the management system.

Job descriptions for managerial, technical, quality and key support personnel are maintained according to the Arizona Department of Administration – Human Resources Division.

A general organizational chart is available in Appendix A and a breakdown of key personnel is available through the agency human resources section.

Records of authorization(s), competence, educational and professional qualifications, training, skills and experience of all technical personnel are maintained.

5.3 ACCOMMODATION AND ENVIRONMENTAL CONDITIONS

The ASPHL facilities are designed and maintained to provide for consistent environmental conditions to facilitate the correct performance of tests. The building located at 250 N. 17th Avenue is maintained by ASPHL Facilities and the building located at 4814 S. 40th Street is maintained by the building owner, Valley Commerce Center, LLC. Technical requirements for accommodation and environmental conditions that can affect the results of tests are written into the laboratory procedures or methods.

The 250 N. 17th Avenue laboratory monitors, controls, and records environmental conditions with the Andover System for monitoring temperature, humidity, and air flows and Computerized Maintenance Management System (CMMS or building management system; SOP FAC-006, Maxpanda Equipment Monitoring). There is remote notification and remote access available that allows 24/7 access to the systems. There are procedures in place as needed and as required by the relevant specifications, methods, and procedures or where they influence the quality of results.

The 4814 S. 40th Street laboratory monitors, controls, and records environmental conditions through the monitoring of equipment and test performance.

Tests are stopped at both locations when the environmental conditions jeopardize the results of tests.

The laboratory has separate analytical areas to minimize and prevent cross-contamination and

incompatible activities. Examples of some measures taken to prevent cross-contamination are: dedicated instruments, protective gear, decontamination procedures, and designated rooms for DNA/chemical extraction.

Both laboratory locations are considered secure facilities and access to the buildings is granted through an elaborate tiered security system. Visitors are granted entry into the laboratory building only during the normal working hours of 8:00 am – 5:00 pm Monday through Friday by a security guard or assigned personnel at the front entrance. Access to the ASPHL facility on weekends is limited to the Shipping and Receiving area which is open to receive samples. Visitors must be escorted into the laboratory areas. Card-reader and/ or number key access is required to gain entry into the laboratory areas. Access to each area may be monitored by camera surveillance.

The cleanliness and safety of the work area is maintained by all staff members of the laboratory.

5.4 TEST AND CALIBRATION METHODS AND METHOD VALIDATION

The ASPHL uses appropriate methods and procedures for all tests within its scope.

- Sample receipt, handling and storage criteria established for tests within the scope follow SOPs and/or work instructions.
- The laboratory has instructions on the operation and use of laboratory equipment and instrumentation in the form of manufacturer's manuals, SOPs, or work instructions.
- Methods are kept up to date and made readily available to personnel.
- Deviations from test methods are authorized only when they are documented, technically justified, and approved by management or QAU.

Selection of methods for testing is conducted using methods appropriate for the specific analytical purpose and meeting the needs of the customer; methods are verified initially and with changes to demonstrate that ASPHL can achieve the required performance. The laboratory typically determines, along with the customer as needed, the methodology to be used for samples submitted by its primary customers. The methods used include standard methods. If a customer asks for a method that is considered inappropriate for the analyte or organism requested or the method is considered out of date, the ASPHL staff will discuss with the customer the appropriate or current method and will document on the submission form or communication log the discussion and final decision.

Laboratory Developed Methods –When laboratory developed methods are to be developed, method development is conducted by competent personnel equipped with adequate resources based on acceptable scientific principles and references and as a planned activity. Plans would be updated as development proceeds and communicated amongst all personnel involved.

Non-standard methods – If it is necessary to use non-standard methods, these methods are subject to customer approval and in-house validation.

Validation of methods – Validation is the process of determining that a specific method performs

as it was intended. The laboratory will validate any non-standard method, laboratory developed method, or standard methods used outside their intended scope. Performance characteristics for validated methods will be evaluated for the intended use and meet the needs of the customer. Records of the validation will be maintained and include the procedure used, specifications, performance characteristics, results obtained, and a statement of the validity and fitness for intended use. SOP QA-030, Method Validation for Food Testing Laboratories.

Validation of forensic methods shall include the associated data interpretation, establish the data required to report results and interpretations, and identify limitations of the method, reported results and interpretations. When changes are made the staff shall determine the influence of the changes and if found to be significant from the original will perform a new validation.

Estimation of Uncertainty of Measurement – Measurement of uncertainty will be considered for each calibration the laboratory performs and for each method of analysis as per SOP QA-032, Measurement of Uncertainty.

Control of Data

Calculations and data transfers are reviewed in a systematic manner.

The laboratory uses computers and automated equipment to acquire, process, record, report, store and retrieve test data. The software used by the laboratory is commercially available.

The laboratory checks calculations run by programs, such as Microsoft Excel, for correctness, examples of equations used for calibration and data reduction are found in Appendix C. It protects the integrity and confidentiality of data, data storage, data transmission and data processing according to Acceptable Use HS100, Confidentiality Policy HS104and Information Security ITS102. The laboratory maintains computers, instruments and LIMS systems to ensure proper functioning to maintain the integrity of the tests.

5.5 EQUIPMENT AND REAGENTS

The laboratory has all equipment required for the correct performance of the tests.

All equipment and computer software used for testing is capable of achieving the accuracy required by the test method. A record of each item of equipment and its software related to the tests are available in the appropriate sections and/or with the Facilities equipment management system for the building. Maintenance records and notes regarding service are maintained next to the instrument, in the section, or for specific items with the building Facilities. See section 5.6 for equipment calibration procedures.

Laboratory equipment is operated by authorized personnel. Current instructions on the use and maintenance of equipment are readily available for use by appropriate personnel. Equipment is uniquely identified where practical.

Log books for instruments with identification are maintained.

Procedures for the safe handling, planned maintenance and use of equipment are described in the

laboratory methods and/or equipment manuals.

Equipment that gives suspect results or is not functioning properly is taken out of service. It is clearly labeled as being out of service until it has been repaired and shown by calibration or test to perform correctly. Suspect equipment is not returned to service until it has demonstrated proper performance. The laboratory determines if the suspect equipment caused production of suspect results and, if necessary, initiates a corrective action procedure as described in SOP QA-016, Root Cause Analysis and Corrective Action Instructions. Refer to section 4.9, Control of Nonconforming Testing and/or Work.

Where practical, equipment requiring calibration is labeled indicating the date when last calibrated and the date when re-calibration is due.

The function and calibration status of equipment sent out for repair is checked by the analyst and shown to be satisfactory before the equipment is returned to service.

Checks used to maintain the confidence in the calibration status of equipment, such as balances and automatic pipettes, are performed according to laboratory procedures.

If correction factors are used, it will be stated in the laboratory procedure.

Test equipment, including hardware and software, shall be safeguarded from adjustments that would invalidate test results by restricted access to the laboratory and through computer security measures.

Reagents prepared by analysts are clearly labeled with a minimum of the name of the reagent, the date of preparation and or a lot number. Records are maintained that identify the analyst who prepared the reagent, the expiration date of the prepared reagent, and the components used. Preparation of radioactive standards also include the certification date and time on the labels for decay corrections.

5.6 MEASUREMENT TRACEABILITY

All equipment that has an impact on the accuracy of results are calibrated and/or verified before use according to procedures which specify the requirements for calibration and interval of calibration.

Traceability of calibrations performed by external services: Companies that are contracted to perform equipment calibration shall provide the laboratory with a calibration certificate/documentation of the traceability to a NIST standard and uncertainty of measurement. These companies, whenever possible, shall be ISO/IEC 17025 accredited, NIST certified, or if no supplier is available that meets the requirements the product or service shall be confirmed to meet the ASPHL needs.

Traceability of calibrations performed by the laboratory: The laboratory uses certified reference materials wherever possible and participates in the designated proficiency testing programs. Measurement uncertainty must be considered. Calibrations must be performed by trained staff, in an appropriate environment, have clear records established and maintained and have a technical

review performed by another individual.

The laboratory uses reference standards traceable to NIST, wherever possible, or traceable to reputable vendors who provide traceability via accredited calibration certificates. These standards shall be calibrated and/or verified according to laboratory procedure.

Certified reference materials are purchased with manufacturer's Certificates of Analysis (CofA) containing appropriate measurement uncertainty estimates, as applicable. The quality of reference materials is verified according to laboratory procedures. Checks needed to maintain confidence in the calibration status of reference standards are performed according to laboratory procedures.

The procedures for handling, transport, storage and use of reference standards and materials are described in laboratory procedures. Refer to SOP QA-037, General Instructions for Safe Handling and Transport of Laboratory Equipment and Reference Standards.

5.7 SAMPLING

The laboratory, except for RML, is not routinely involved with sample collection but provides some guidance in the *Guide to Laboratory Services*. In those cases where the laboratory is involved, the laboratory will comply with program requirements defined by the customer. For RML, the laboratory routinely collects the majority of samples analyzed and describes these processes in section specific SOPs.

The laboratory procedures for sub-sampling and/or homogenization are described in SOPs or methods.

5.8 HANDLING OF TEST AND CALIBRATION ITEMS

Procedures for the receipt, handling, protection, storage, retention and disposal of samples are described in laboratory procedures. The laboratory will follow handling instructions provided by the manufacturer or provider of test materials, such as standards, quality control, reference samples, and other items.

The laboratory's Laboratory Information Management System (LIMS; StarLIMS or MSC-LIMS) is used for assigning a unique identification number to the samples. The identification number is retained throughout the life of the sample in the laboratory and helps to ensure that samples are not confused physically or when referred to in records or other documents.

Upon receipt of samples, abnormalities or departures are recorded according to sample acceptability and rejection criteria. If there is doubt as to the suitability of a sample, the laboratory will contact the customer for further instructions before proceeding and will record the communication and outcome.

Samples are protected from deterioration, loss or damage during storage, handling, and preparation according to laboratory procedures and analytical methods. They also address security and protecting sample integrity.

Samples that are considered evidence in forensic toxicology shall be received under chain of custody, ensure that the integrity of the items are maintained through storage, packaging and sealing, and require communication to customers regarding the disposition of samples received.

- Chain of custody includes the individual or location receiving or transferring the samples.
- The samples being transferred.
- The chronological order of all transfers, at a minimum this would be the date of transfer.

5.9 ENSURING THE QUALITY OF TEST AND CALIBRATION RESULTS

Calibration curves on test instruments are generated using a minimum of three calibration standards when the method does not specify. Refer to individual methodologies for numbers of standards and levels employed. Screening procedures generally employ one verification standard. A calibration curve is established as described in individual Standard Operating Procedures (SOPs). Curves are calculated using linear regression, quadratic, logarithmic, instrument-specific algorithms' best-fit models or response factors, examples of equations used for calibration and data reduction are in Appendix C. For analyses amenable to regression calculations, Pearson's Correlation Coefficient must be equal to or greater than 0.995.

The accuracy of a primary source standard is verified by the analysis of a secondary source standard that has been prepared from a separate source than that of the primary standard whenever possible. Performance check logs are maintained on instrumental parameters and compared with each analysis.

The laboratory monitors the quality of test results by the inclusion of quality control measures in the performance of tests and participation in proficiency testing programs. The laboratory runs appropriate controls with each batch of samples. Control charts for the internal quality control checks are maintained and reviewed by the analyst/Section Supervisor on a routine basis for applicable methods. An out-of-control situation is defined as any point beyond the control limits. The use of external quality control samples of unknown value (splits, spikes, reference samples, inter-laboratory checks) are evaluated by the Section Supervisor/Office Chief/QA Unit for acceptability. The criteria for acceptability are as defined by the supplier of the sample if the sample is from a reference source such as EPA, NIST, AIHA, CDC, FDA, USDA, or a commercial supplier. If the source is not considered a reference source, the criteria may be established by comparison of the true value and reported values to established in-house criteria (e.g., spike recovery windows) or by joint consultation between the QA Unit and the Chief and Supervisor. The QA Unit monitors the acceptability rate and corrective actions. The Laboratory Director is kept apprised of the status.

If available, the laboratory uses an ISO/IEC 17043 compliant Proficiency Testing Provider for environmental, food, and toxicology testing methods. The laboratory participates in customer specified challenge events when a proficiency testing provider is not available. When multiple analysts perform the same test, the proficiency sample (or interlaboratory or challenge) shall be rotated among the staff.

Appropriate controls for each analytical batch are evaluated to ensure that they meet acceptance

criteria. The controls to be analyzed for each method, their acceptance criteria, and the actions to be taken upon a control deviation are described in the methods.

Any deviations made to the test will be recorded in the appropriate worksheet, logbook, or other record and will be discussed with the customer.

The analyst processes the raw data obtained from analytical measurements into a reportable format as part of the data reduction process. Each SOP and/or method describes data reduction and method of conversion of raw data, if applicable. The Section Manager or designee reviews the results of a set of analyses before transfer of those data to data sheets. Data sheets are transcribed into the laboratory information management system (StarLIMS or MSC-LIMS). The Chief or designee reviews the transcription after computer entry. Both the Chief and the Section Manager or designee also evaluates the final report for any inconsistencies. High priority sample results or significant results are reported verbally and can be followed by written Preliminary Reports transmitted for confirmation if desired by the client.

StarLIMS allows for the transfer of electronic data, where applicable, through data capture units (DCU) directly into the StarLIMS database, where it can be reviewed and approved and reports generated.

All data generated is reviewed by a peer, someone other than the individual that produced the data, and documented as to who performed the review, at a minimum the date of the review, and any notes regarding the data.

5.10 REPORTING RESULTS

The laboratory prepares test reports that state the results clearly and accurately, containing the information agreed upon with the customer. The laboratory does not issue calibration reports.

The LIMS has security levels of authorization that prevent unauthorized production of reports.

Test report format and content are agreed upon by the laboratory and the customer, and adhere to EPA, ISO/IEC 17025 standard and ANAB requirements where appropriate. Minimum reporting elements are provided in Appendix B.

When opinions, interpretations, or data qualifiers are included in a test report, they are clearly indicated as such and the appropriate references are listed. When decision rules are employed for conformity specifications they will be clearly identified and the reports will indicate which results the rule applies to and if the specifications were met or not met.

Results of tests performed by subcontractors are clearly identified on test reports.

When results are transmitted by telephone, facsimile or electronic means, the requirements of EPA, the ISO/IEC 17025 standard, and the customer are met.

The format of reports used to issue results is designed to be easily understood and to meet the needs of the customer. As long as the minimum elements provided in Appendix B are included, the report format can be adjusted for the needs of the customer (e.g. spreadsheets, data transfer

files, hard copy, etc.).

Amendments to sample reports that are made after issue are made in the form of an additional document or data transfer that contains the statement "Amended Report" and the change is clearly identified.

6.0 CONCLUSION

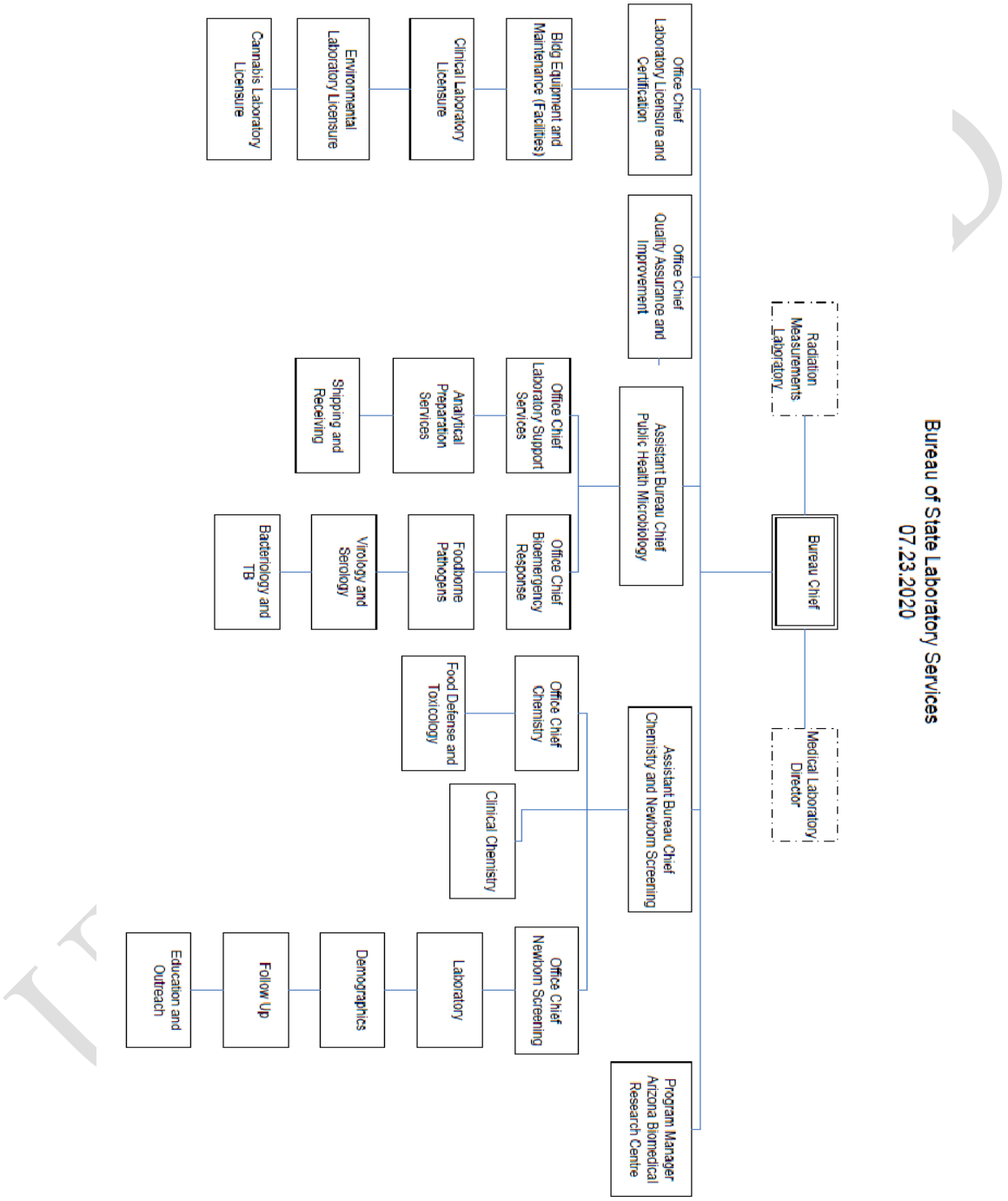
Quality assurance activities and improvements are continual and dynamic. The laboratory reviews its procedures, processes, requirements and practices continually in an effort to assure its clients that reliable, verifiable and court defensible analytical results have been produced. All levels of staffing including management are involved in this process and share the responsibility. The Arizona State Public Health Laboratory is dedicated to the practice of utmost quality in its work product. Therefore, we welcome constructive criticisms that will improve our performance.

7.0 SUMMARY OF CHANGES FROM PREVIOUS REVISION

- Added language throughout regarding the Radiation Measurements Laboratory (RML) following the ASPHL quality system.
- Minor wordsmithing in places and update of ADHS policy numbers.
- Section 4.6 Purchasing updated to better reflect current process.
- Section 5.5 Equipment/Reagent updated to include label expiration date and for radiation standards to label with date and time of certification.
- Section 5.7 Sampling updated to include that RML performs majority of sampling for program.
- Appendix B updated to reflect changes from ISO/IEC 17025: 2005 to 2017 reporting requirements and provided clarification as needed including amended reports.
- Appendix C updated to include examples of RML equations.

Appendix A – Organizational Chart

Organizational charts listing current organizational structure and staff members are available upon request.



Appendix B – Final Report Elements

ASPHL ensures that the minimum reporting elements for EPA drinking water and ISO/IEC 17025 are included when providing final results. An exception would be for ISO/IEC 17025 clients who request specific reporting elements or formatting to be provided with their samples.

Minimum elements for an EPA and ISO/IEC 17025 final report:

- Title to indicate final results – e.g. Final Report or Amended Report when applicable
- The name, address, and telephone number of the laboratory
    - Any test not performed by ASPHL is clearly marked with the name and location of the laboratory that performed the test.
- A unique identification assigned to sample, ADHS accession number
- Date the report was approved/released
- Page numbers (e.g. Page 1 of 1)
- Submitter name and address
- Submitter identification
- Identification of each test method used to obtain reported results.
    - Note: Forensic Toxicology requires the equipment/instrument used to be listed.
- Sample type
- Sample description – when necessary include condition of sample received
- Sample collection date
- Sample collection time
    - Note: Included for food testing when available
- Sampling plan or sampling method
    - Applicable to RML, other ASPHL sections do not typically sample and do not have plans or procedures in place and do not reference client sampling plans or procedures unless requested.
- Date received
- Chain of custody, if requested
- Results
- Analysis date
    - Note: This is not typically requested by ASPHL food microbiology submitters and is not routinely included on these reports. The analysis date is available upon request.
- Units of measurement, where applicable
- Name and signature (electronic accepted) of individual authorizing release of results
- Any deviations from standard practice, sample condition, interpretations (as applicable) or other items are clearly noted on the final report.

Appendix C – Examples of Equations Used for Calibration and Data Reduction

The following equations are the examples of calibration equations typically used in the laboratory. Individual instrumentation may have modifications to the equations listed below.

Response Factor/Calibration Factor Equations:

External Standard Equation

$$CF = (Ax)/(Cx)$$

Or

Internal Standard Equation

$$RF = ((Ax)(Cis))/((Ais)(Cx))$$

Where: Ax = Area of the compound
Cx = Concentration of the compound
Ais = Area of the internal standard
Cis = Concentration of the internal standard

Response Factor/Calibration Factor Statistical Equations:

Average RF or CF: $RF_{AVE} = (\sum RF_i / n)$

Standard Deviation (s): $s = \sqrt{ \{ [\sum (RF_i - RF_{AVE})^2] / (n-1) \}}$

Relative Standard Deviation (RSD): $RSD = s / RF_{AVE} * 100$

Where: n = number of pairs of data
RF_i = Response Factor for each level
RF_{AVE} = Average of all the response factors
$\sum$ = the sum of all the individual values

In the equations above RF can be replaced with CF

Linear Calibration Equation:

$$y = mx + b$$

Where: y = Response Ax for External Standard or Ax/Ais for Internal Standard
x = Concentration Cx for External Standard or Cx/Cis for Internal Standard
m = Slope
b = Intercept

Linear Regression Equation:

Correlation Coefficient (r)

$$r = \frac{[(\sum w * \sum wxiyi) - (\sum wxi * \sum wyi)]}{\sqrt{\{[(\sum w * \sum wxi^2) - (\sum wx * \sum wxi)] * [(\sum w * \sum wyi^2) - (\sum wyi * \sum wyi)]\}}}$$

Coefficient of Determination (r^2)

$$r^2 = r * r$$

Where n = number of x, y pairs
xi = individual values for the independent variable
yi = individual values for the dependent variable
w = weighting factor, for equal or no weighting w = 1
xAVE = average of the x values
yAVE = average of the y values
$\sum$ = the sum of all the individual values

Quadratic Calibration Equation:

$$y = ax^2 + bx + c$$

Where: y = Response Ax for External Standard or Ax/Ais for Internal Standard
x = Concentration Cx for External Standard or Cx/Cis for Internal Standard

Coefficients (a, b, c)

$$a = \frac{\{[\sum (x^2y) * \sum (xx)] - [\sum (xy) * \sum (xx^2)]\}}{\{[(\sum (xx) * \sum (x^2x^2)] - [\sum (xx^2)]^2\}}$$

$$b = \frac{\{[\sum (xy) * \sum (x^2x^2)] - [\sum (x^2y) * \sum (xx^2)]\}}{\{[(\sum (xx) * \sum (x^2x^2)] - [\sum (xx^2)]^2\}}$$

$$c = [(\sum yi)/n] - \{b * [(\sum xi)/n)]\} - \{a * [\sum (xi^2)/n]\}$$

Where:

$$\sum (xx) = (\sum xi^2) - [(\sum xi)^2/n]$$
$$\sum (xy) = (\sum xiyi) - [(\sum xi)*(\sum yi)/n]$$
$$\sum (xx^2) = (\sum xi^3) - [(\sum xi)*(\sum xi^2)/n]$$
$$\sum (x^2y) = (\sum xi^2yi) - [(\sum xi^2)*(\sum yi)/n]$$
$$\sum (x^2x^2) = (\sum xi^4) - [(\sum xi^2)^2/n]$$

Quadratic Regression Equation:

Coefficient of Determination (r^2)

$$r^2 = \frac{[\sum(yi\text{-}yAVE)^2] - \{[(n-1)/(n-p)] * [\sum(yi\text{-}Yi)^2]\}}{\sum(yi-yAVE)^2}$$

Where: yi = individual values for each dependent variable
xi = individual values for each independent variable
yAVE = average of the y values
n = number of pairs of data
p = number of parameters in the polynomial equation (i.e., 3 for third order, 2 for second order)
Yi = $\{[(2a*(Cx/Cis)^2]-b^2+b+(4ac)\}/(4a)$
$\sum$ = the sum of all the individual values

Weighting an equation:

Calibration equations may be weighted in order to obtain more accurate values or to provide more emphasis on the lower or higher portions of the calibration. Below are examples of the various weights that may be used in a calibration.

No Weights:	Default higher weighting of higher amounts or signal values
1/Amount:	Nearly cancels out the weighting of higher amounts
1/Amount^2:	Causes weighting of smaller amounts
1/Response:	Nearly cancels out the weighting of higher signal values
1/Response^2:	Causes weighting of smaller signal values
1/RSD:	Weights signal values with small relative standard deviations more than those with large relative standard deviations
1/RSD²:	Weights signal values with small relative standard deviations clearly more than those with large relative standard deviation.

Radiochemistry Wet Chemistry Equations:

$$Sample\ Activity\ \left(\frac{pCi}{L}\right) = \frac{Net_{cpm}}{V * 2.22 * Eff}$$

$$Standard\ Uncertainty\ (2\ sigma) = \frac{1.96 * \left(\sqrt{\frac{S_{cpm}}{t_s} + \frac{B_{cpm}}{t_B}}\right)}{V * 2.22 * Eff}$$

$$\text{EPA } Detection\ Limit\ (2\ sigma) = \frac{1.96^2}{2t_s} * \left[\frac{1+\left(\sqrt{\frac{1+4t_S^2}{1.96*B_{cpm}}}\right)*\left(\frac{1}{t_S}+\frac{1}{t_B}\right)}{V*2.22*Eff}\right]$$

$$SM\ Detection\ Limit\ (2\ sigma) = \frac{\left(4.66 * \sqrt{\frac{B_{cpm}}{t_B}}\right)}{Eff * V}$$

$$Relative\ Percent\ Difference\ (RPD) = \left(\frac{|A_1 - A_2|}{(Average(A_1, A_2))}\right) * 100$$

$$Replicate\ Error\ Ratio\ (RER) = \frac{(|A_1 - A_2|)}{\sqrt{(s_A^2 + s_B^2)}} \leq 2$$

Where RML Equations:

A_1 = Net activity of first measurement
A_2 = Net activity of next measurement
s_A^2 = Squared Uncertainty (1 sigma) of first measurement
s_B^2 = Squared Uncertainty (1 sigma) of next measurement
S_{cpm} = Sample counts per minute
S_t^2 = Sample count time squared
B_{cpm} = Background counts per minute
B_t^2 = Background count time squared
t_s = Sample count time
t_B = Background count time
V = Sample Volume
Eff = Sample Efficiency

Net_{cpm} = Sample counts per minute minus background counts per minute

Grubbs' Test for Statistical Outliers:

This test is used for making statistical decisions on the rejection of outliers.

Calculate T:

$$T = \frac{X_{(ave)} - X_1}{S}$$

or

$$T = \frac{X_n - X_{(ave)}}{S}$$

Where: $X_{(ave)}$ = average of the X values
X_1 = the smallest of the X values
X_n = the largest of the X values

Compare T with the values in the following table. If T is larger than the tabulated value, rejection may be made with an associated risk of 5%.

Number of data points	Critical Values for T @ 5%	Number of data points	Critical Values for T @ 5%
3	1.153	22	2.603
4	1.463	23	2.624
5	1.672	24	2.644
6	1.822	25	2.663
7	1.938	26	2.681
8	2.032	27	2.698
9	2.110	28	2.714
10	2.176	29	2.730
11	2.234	30	2.745
12	2.285	31	2.759
13	2.331	32	2.773
14	2.371	33	2.786
15	2.409	34	2.799

16	2.443	35	2.811
17	2.475	36	2.823
18	2.504	37	2.835
19	2.532	38	2.846
20	2.557	39	2.857
21	2.580	40	2.866

Reference: Quality Assurance of Chemical Measurements, J.K. Taylor, Lewis Publishers 1987; and "Extension of Sample Sizes and Percentage Points for Significance Tests of outlying Observations," F.E. Grubbs and G. Beck, Technometrics, TCMTA, 14 (No. 4) 847-54 (November 1974).

Appendix D: Notification of Action Level Exceedance

Follow-Up Sampling Event - Elevated initial, non-elevated flush, recommend flush template

(flushing sample(s) non-elevated)

Dear [charter school facility name],

Attached please find all lead follow-up results for drinking water samples collected from [insert charter school facility name]. The follow-up water testing involved taking two samples from all drinking water fixtures. The first sample was taken when water hadn't been used for an extended period of time, and the second "flushed" sample was taken after water had been running for 30 seconds. **One or more of the samples had lead above the screening level prior to flushing, but were below the Environmental Protection Agency's (EPA) action level after flushing.** It is recommended that staff and students flush the filter for 30 seconds prior to each use. You may consider having your plumbing system inspected by a professional to reduce lead levels in your water.

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

See below for recommendations from the *3Ts for Reducing Lead in Drinking Water Manual* or visit the EPA website here.

- Consider using a Point-of-Use filter to reduce lead in your tap water. Distillation, reverse osmosis and some carbon filters can remove lead. Be sure to look for products certified to remove lead by NSF International, Underwriters Laboratories, or Water Quality Association. It is important to follow all manufacturer guidelines for installation and maintenance of the filter. For more information about water filtration systems visit the EPA's website.
- Post a sign on the fixture instructing staff and students to flush for 30 seconds prior to each use until a permanent solution is in place.
- Use bottled water for drinking or food preparation until retesting is completed and lead levels are below the federal drinking water standard.

Refer to the frequently asked questions or contact the Arizona Department of Health Services' Childhood Lead Poisoning Prevention Program at 602-364-3118 if you have additional questions.

For screening program updates and additional resources, please feel free to visit our program website at [website address].

Sincerely,

XXXXXXX

Initial Sampling Event - Elevated flushed, schedule follow-up testing template

(flushing sample(s) elevated)

Dear [charter school facility name],

Attached please find all lead results for drinking water samples collected from [insert charter school facility name]. The water testing involved taking two samples from up to 10 drinking water fixtures. The first sample was taken when water hadn't been used for an extended period of time, and the second "flushed" sample was taken after water had been running for 30 seconds. **One or more of the samples had lead above the Environmental Protection Agency's (EPA) action level, even after flushing for 30 seconds. This water should not be used for drinking or preparing food.** We would like to schedule follow-up testing for your facility to test all drinking water fixtures for lead.

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

See below for recommendations from the *3Ts for Reducing Lead in Drinking Water Manual* or visit the EPA website here to take while follow-up sampling is being conducted:

- Shut off or disconnect outlets with elevated lead levels until the problem is resolved.
- Post a "Not for Drinking/Cooking" sign at the fixture with elevated lead levels until the problem is resolved. The fixture can be used for purposes other than human consumption such as hand-washing.
- Consider using a Point-of-Use filter to reduce lead in your tap water. Distillation, reverse osmosis and some carbon filers can remove lead. Be sure to look for products certified to remove lead by NSF International, Underwriters Laboratories, or Water Quality Association. It is important to follow all manufacturer guidelines for installation and maintenance of the filter. For more information about water filtration systems visit the EPA's website.
- Use bottled water for drinking or food preparation until retesting is completed and lead levels are below the federal drinking water standard.

Refer to the frequently asked questions or contact the Arizona Department of Health Services' Childhood Lead Poisoning Prevention Program at 602-364-3118 if you have additional questions.

For screening program updates and additional resources, please feel free to visit our program website at [website address].

Sincerely,

XXXXXXX

Initial Sampling Event - Elevated, recommend flush template

(flushing sample(s) non-elevated)

Dear [charter school facility name],

Attached please find all lead results for drinking water samples collected from [insert charter school facility name]. The water testing involved taking two samples from up to 10 drinking water fixtures. The first sample was taken when water hadn't been used for an extended period of time, and the second "flushed" sample was taken after water had been running for 30 seconds. **One or more of the samples had lead above the screening level prior to flushing, but were below the Environmental Protection Agency's (EPA) action level after flushing.** It is recommended that staff and students flush the filter for 30 seconds prior to each use. You may consider having your plumbing system inspected by a professional to reduce lead levels in your water.

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

See below for recommendations from the EPA *3Ts for Reducing Lead in Drinking Water Manual* or visit the EPA website here.

- Consider using a Point-of-Use filter to reduce lead in your tap water. Distillation, reverse osmosis and some carbon filters can remove lead. Be sure to look for products certified to remove lead by NSF International, Underwriters Laboratories, or Water Quality Association. It is important to follow all manufacturer guidelines for installation and maintenance of the filter. For more information about water filtration systems visit the EPA's website.
- Post a sign on the fixture instructing staff and students to flush for 30 seconds prior to each use.

Refer to the frequently asked questions or contact the Arizona Department of Health Services' Childhood Lead Poisoning Prevention Program at 602-364-3118 if you have additional questions.

For screening program updates and additional resources, please feel free to visit our program website at [website address].

Sincerely,

XXXXXXX

Dear Parents and Guardians,

On [date], the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was screened for lead and found to have lead above the action level. ADHS conducted follow-up water testing at our facility. **One or more of our drinking water fixtures contained lead above the action level**. We are acting upon these results by identifying the repairs and/or changes that are necessary. We will keep you updated on our progress and informed throughout the process. Until all repairs are completed, and our water has been retested, we will be using bottled water for drinking and food preparation.

Important Information

- Our facility's water is safe for hand washing, cleaning, and toilet use.
- We will post a "Not for Drinking/Cooking" sign at the fixture(s) with elevated lead levels until the problem is resolved.
- Use bottled water for drinking or food preparation until retesting is completed and lead levels are below the federal drinking water standard.
- Drinking water is not a common source of lead poisoning in Arizona. Children may be exposed to other potential sources of lead in their homes. To learn more about common sources of lead in Arizona, please visit the Parent Portal on the ADHS Childhood Lead Poisoning Prevention Program at *www.azhealth.gov/lead.*
- ADHS does not recommend that you get your child tested for lead exposure based on a lead reading above the action level in water at the school. Blood lead testing is recommended for children at 12 and 24 months age of age if the child lives in a high risk zip code. A list of high risk zip codes can be found on the ADHS webpage at *www.azhealth.gov/lead.* Consult your child's health care provider if you have additional health concerns or feel your child has been exposed to other sources of lead.

Please note that our first priority is the health and safety of your child(ren). We will keep you updated on our progress and informed throughout the process. For more information, please review the attached Frequently Asked Questions for Parents or visit the program website *[website address].*

If you have additional questions about lead poisoning, please contact ADHS' Childhood Lead Poisoning Prevention Program at 602-364-3118.

Sincerely,

(Facility Director)

Dear Parents and Guardians,

On [date], the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was screened for lead and found to have lead above the action level. ADHS conducted follow-up water testing at our facility and we are pleased to report that the lead confirmatory results were **less than the action level for all drinking water fixtures in our facility**. No additional actions are needed at this time and our water can be safely used.

To learn more about the program, visit the program website: [website address]

Sincerely,

(Facility Director)

Dear Parents and Guardians,

On (date), the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was screened for lead as a part of this program and found to have lead above the action level. ADHS conducted follow-up water testing at our facility. The follow-up water testing involved taking samples before the facility opened when water hadn't been used for an extended period of time, and a second "flushed" sample after water had been running for 30 seconds. One or more of the "pre-flushed" samples had lead above the action level, however **all "flushed" samples came back below the action level**. To ensure lead levels are consistently below the action level, we will institute a flushing program by letting water run at drinking water fixtures for at least 30 seconds prior to use at the beginning of each day.

Important Information

- We will ensure our facility's water is safe for drinking, food preparation, hand washing, cleaning and toilet use by adopting a flushing program at fixtures with elevated lead levels at the beginning of each day.
- Drinking water is not a common source of lead poisoning in Arizona. Children may be exposed to other potential sources of lead in their homes. To learn more about common sources of lead in Arizona, please visit the Parent Portal on the ADHS Childhood Lead Poisoning Prevention Program at *www.azhealth.gov/lead.*
- It is not recommended that you get your child tested for lead exposure based on a lead reading above the action level in water at the school. Blood lead testing is recommended for children at 12 and 24 months of age if the child lives in a high risk area. Enter your child's full address on the website *www.azhealth.gov/leadmap* to determine whether your child needs a blood test.

Please note that our first priority is the health and safety of your child(ren). For more information, please review the attached Frequently Asked Questions for Parents or visit the program website *[website address].*

If you have additional questions about lead poisoning, please contact ADHS' Childhood Lead Poisoning Prevention Program at 602-364-3118.

Sincerely,

(Facility Director)

Dear Parents and Guardians,

On (date), the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was screened for lead as a part of this program and found to have lead above the action level. The water testing involved taking samples before the facility opened when water hadn't been used for an extended period of time, and a second "flushed" sample after water had been running for 30 seconds. **One or more of the "flushed" samples contained lead above the action level.** ADHS will conduct additional follow-up sampling at our facility to test all drinking water fixtures for lead. To ensure the safety of all children and staff, lead mitigation measures will be taken while follow-up sampling is being conducted.

Important Information

- Our facility's water is safe for hand washing, cleaning, and toilet use.
- We will post a "Not for Drinking/Cooking" sign at the fixture(s) with elevated lead levels until the problem is resolved.
- Use bottled water for drinking or food preparation until retesting is completed and lead levels are below the federal drinking water standard.
- Drinking water is not a common source of lead poisoning in Arizona. Children may be exposed to other potential sources of lead in their homes. To learn more about common sources of lead in Arizona, please visit the Parent Portal on the ADHS Childhood Lead Poisoning Prevention Program at *www.azhealth.gov/lead.*
- ADHS does not recommend that you get your child tested for lead exposure based on a lead reading above the action level in water at the school. Blood lead testing is recommended for children at 12 and 24 months of age if the child lives in a high risk area. Enter your child's full address on the website *www.azhealth.gov/leadmap* to determine whether your child needs a blood test.

Please note that our first priority is the health and safety of your child(ren). We will keep you updated on our progress and informed throughout the process. For more information, please review the attached Frequently Asked Questions for Parents or visit the program website *[website address].*

If you have additional questions about lead poisoning, please contact ADHS' Childhood Lead Poisoning Prevention Program at 602-364-3118.

Sincerely,

(Facility Director)

Dear Parents and Guardians,

On [date], the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was tested for lead as part of this program. We are pleased to report that the lead screening results were **below the action level**. No additional actions are needed at this time.

To learn more about the program, visit the program website: [website address]

Sincerely,

(Facility Director)

Second Sampling Event-elevated follow-up, repairs recommended template

(flushed sample(s) elevated)

Dear [charter school facility name],

Attached please find all lead follow-up results for drinking water samples collected from [insert charter school facility name]. The follow-up water testing involved taking two samples from all drinking water fixtures. The first sample was taken when water hadn't been used for an extended period of time, and the second "flushed" sample was taken after water had been running for 30 seconds. **One or more of the samples had lead above the Environmental Protection Agency's (EPA) action level, even after flushing for 30 seconds. This water should not be used for drinking or preparing food.**

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

See below for recommendations from the EPA *3Ts for Reducing Lead in Drinking Water Manual* or visit the EPA website here.

- Shut off or disconnect outlets with elevated lead levels until the problem is resolved.
- Post a "Not for Drinking/Cooking" sign at the fixture with elevated lead levels until the problem is resolved. The fixture can be used for purposes other than human consumption such as hand-washing.
- Consider using a Point-of-Use filter to reduce lead in your tap water. Distillation, reverse osmosis and some carbon filers can remove lead. Be sure to look for products certified to remove lead by NSF International, Underwriters Laboratories, or Water Quality Association. It is important to follow all manufacturer guidelines for installation and maintenance of the filter. For more information about water filtration systems visit the EPA's website.
- Use bottled water for drinking or food preparation until retesting is completed and lead levels are below the federal drinking water standard.
- Consult with a qualified contractor to determine what repairs are needed to address lead contamination in your plumbing system.
- After repairs have been completed, consult with a qualified contract to retest the drinking water to ensure lead levels are below the federal drinking water standard of 15 parts per billion (ppb).

Refer to the frequently asked questions or contact the Arizona Department of Health Services' Childhood Lead Poisoning Prevention Program at 602-364-3118 if you have additional questions.

For program updates and additional resources, please feel free to visit our program website at [website address].

Sincerely,

XXXXXXX

Follow-Up Sampling Event - Non-elevated results email template

Dear [charter school facility name],

Attached please find all lead follow-up results for drinking water samples collected from [insert charter school facility name.] A second round of sampling was completed for your facility because one or more of the drinking water fixtures sampled contained lead above the Environmental Protection Agency's action level during the initial sampling event. All follow-up samples were below the action level. **No additional water testing or actions are needed at this time.**

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

For screening program updates and additional resources feel free to visit our program website at [website address]. Information on lead remediation strategies and routine practices from the *3Ts for Reducing Lead in Drinking Water Manual* can be found on the EPA website here.

Sincerely,

xxxxxx

Initial Sampling Event - Non-elevated results email template

Dear [charter school facility name],

Attached please find all lead results for drinking water samples collected from [insert charter school facility name.] All samples were below the Environmental Protection Agency's action level. **No additional water testing or actions are needed at this time.**

Attached you will find a sample letter in the event you would like to inform parents about the sampling results.

For screening program updates and additional resources feel free to visit our program website at [website address]. Information on lead remediation strategies and routine practices from the *3Ts for Reducing Lead in Drinking Water Manual* can be found on the EPA website here.

Sincerely,

xxxxxx

Dear Parents and Guardians,

On (date), the Arizona Department of Health Services (ADHS) launched a program to screen drinking water for lead in public charter schools across Arizona. The purpose of the program is to increase awareness of lead poisoning prevention among parents and caregivers of children, who are most vulnerable to lead poisoning, and to identify drinking water sources that contain lead above the Environmental Protection Agency's action level.

Our drinking water was screened for lead as a part of this program and found to have lead above the action level. The water testing involved taking samples before the facility opened when water hadn't been used for an extended period of time, and a second "flushed" sample after water had been running for 30 seconds. One or more of the "pre-flushed" samples had lead above the action level, however **all "flushed" samples came back below the action level**. To ensure lead levels are consistently below the action level, we will institute a flushing program by letting water run at drinking water fixtures for at least 30 seconds prior to use at the beginning of each day.

Important Information

- We will ensure our facility's water is safe for drinking, food preparation, hand washing, cleaning and toilet use by adopting a flushing program at fixtures with elevated lead levels at the beginning of each day.
- Drinking water is not a common source of lead poisoning in Arizona. Children may be exposed to other potential sources of lead in their homes. To learn more about common sources of lead in Arizona, please visit the Parent Portal on the ADHS Childhood Lead Poisoning Prevention Program website at *www.azhealth.gov/lead*.
- It is not recommended that you get your child tested for lead exposure based on a lead reading above the action level in water at the school. Blood lead testing is recommended for children at 12 and 24 months of age if the child lives in a high risk area. Enter your child's full address on the website *www.azhealth.gov/leadmap* to determine whether your child needs a blood test.

Please note that our first priority is the health and safety of your child(ren). For more information, please review the attached Frequently Asked Questions for Parents or visit the program website *[website address]*.

If you have additional questions about lead poisoning, please contact ADHS' Childhood Lead Poisoning Prevention Program at 602-364-3118.

Sincerely,

(Facility Director)

Appendix E: Sampling Plan

Sampling Plan Template

INTRODUCTION

This Lead Drinking Water Testing Sampling Plan was developed by the Arizona Department of Health Services (ADHS), based on the Environmental Protection Agency's "3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities", to establish a plan for sampling lead in drinking water fixtures used for consumption or food preparation in every public charter school within the state of Arizona.

SCHOOL SAMPLING PRIORITY

ADHS compiled a list of all public charter schools in Arizona that are invited to participate in this voluntary drinking water testing program.

Public charter schools were prioritized based on:

- Age of students; and
- Use of fixture by students; and
- Year school was built

Instructions

1. **WALKTHROUGH**

Prior to the initial sampling event, a walkthrough and inventory of each public charter school should be completed.

A. All sinks and fountains used for human consumption including drinking water or food preparation should be identified and marked with a unique identification on the floor plan.
B. Take note of any fixtures with filters or aerators currently in place; aerators will not be removed during the sampling process.
C. Look under sinks and in cabinets to identify plumbing with leaks which could impact the stagnation of water in the pipes.
D. During the walkthrough, try to identify any water coolers listed in the EPA "3Ts for Reducing Lead in Drinking Water in Schools and Child Care Facilities" that contain lead and need to be removed. These water coolers should not be used and should be excluded from sampling events.
E. It may be helpful to speak with the school staff to determine which fixtures are used most frequently.

2. Complete the plumbing profile

Plumbing Profile Questions	**Answer**
1. When was the original building constructed? Were any buildings or additions added to the original facility? If so, complete a separate plumbing profile for each building, addition, or wing.	
2. If built or repaired since 1986, were "lead-free" plumbing and solder used in accordance with the "lead-free" requirements of the 1986 Safe Drinking Water Act Amendments? What type of solder has been used?	
3. When were the most recent plumbing repairs made? Note the locations.	
4. What materials is the service line connection (the pipe that carries water to the school or child care facility from the public water system's main in the street) made of? Note the locations where the service line enters the building and connects to the interior plumbing.	
5. What are the potable water pipes made of in the facility? Examples include: Lead, plastic, galvanized metal, cast iron, copper, other. Note the location of the different types of pipe, if applicable, and the direction of water flow through the building. Note the areas of the building that receive water first and which areas receiver water last.	
6. Are there tanks in the plumbing system (e.g., pressure tanks or gravity storage tanks)?	Y / N

Note the locations of any tanks and any available information about the tanks (e.g., manufacturer or date of installation).	
7. Was lead solder used in the plumbing system? Note the locations with lead solder.	Y / N
8. Are brass fittings, faucets or valves used in the drinking water system? (Note: Most faucets are brass on the inside.) You may want to note the locations on a map or diagram of their facilities and make extensive notes that would facilitate future analysis of lead sample results.	Y / N
9. How many of the following outlets provide water for consumption? Water coolers, water fountains with central chillers, cold water taps, ice makers, kitchen taps, or drinking fountains. Note the locations?	
10. Have you checked the brands and models of water coolers and compared them to the listing of banned water coolers in Appendix B of the "3Ts to Reduce Lead in Drinking Water in Schools and Child Care Facilities" document? Note the locations of any banned coolers.	
11. Do outlets that provide drinking water have accessible screens or aerators? (Standard faucets usually have aerator or screens. Many coolers and fountains also have inlet strainer screens.) If so, have the screens been cleaned? Note the locations.	Y / N

12. Are there signs of corrosion, such as frequent leaks, rust-colored water, or stained dishes or laundry? Note the locations.	Y / N
13. Is any electrical equipment grounded to water pipes? Note the locations.	Y / N
14. Have there been any complaints about bad (metallic) taste? Note the locations.	
15. Check building files and ask the public water system to determine whether any water samples have been taken from the building for any contaminants. Name of contaminant(s)? What concentrations of the contaminant(s) were found? What was the pH? Is testing done regularly at the facility?	
16. Other plumbing questions: Are blueprints of the building available? Are there known plumbing "dead-ends", low use areas , existing leaks, or other "problem areas"? Are renovations being planned for part or all of the plumbing system?	

The purpose of completing this profile is to characterize the plumbing infrastructure of each school and identify potential sources of lead (e.g., lead service lines, lead solder).These questions may help determine sampling locations for the initial sampling event.

2. SAMPLE LOCATION IDENTIFICATION

Use knowledge acquired during the walkthrough, plumbing profile, and discussions with the school's staff to determine where to take samples and how to prioritize sample sites. Fixtures used for human consumption including drinking fountains, kitchen sinks, classroom combination

sinks, home economics sinks, teachers' lounge sinks, nurse's office sinks, and any other fixtures used for consumption should be sampled while fixtures not used for consumption such as janitor's sinks and outdoor hoses should not be sampled. Fixtures used by children under 6 years of age or pregnant women should be prioritized.

Code System for Samples

Each sample should have its own unique identifier to enable accurate tracking and identification of samples by collectors and laboratory personnel. The unique identifier will consist of the school entity ID included on the list of public charter schools provided to the counties and the contractor (e.g., 91204), the room number where the fixture is located, the outlet type, and the sample number.

The codes used for outlet type are as follows:
KS= Kitchen Sink
CS= Classroom Sink
IF= Indoor Drinking Fountain
OF= Outdoor Drinking Fountain
OT= Other, please specify (e.g., nurse's office sink, teachers' lounge sink, etc.)

Sample Location	**Justification for Selection**	**Sample ID**

Appendix F: Sampling Schedule

Scheduling Log

Charter School Entity ID	Contact Name	Contact Phone Number	Contact Email	Facility Agreed to Sampeling	If No, Please Select the Reason

Date the First Sampling Was Conducted	Date the Charter School Was Notified of the First Sampling Results	Is Flush Sampling Necessary?	If YES, Indicated Date the Flush Sampling Was Conducted	Date the Charter School Was Notified of the Flushing Results

Appendix G: Field Sampling Log

Charter School Entity ID:	**Sample Date (MM/DD/YYYY):**
School County:	**Sampler's Name:**
Year Building Built:	

Sample ID = School Entity ID--Room Number-Outlet Type-Sample Number
(e.g. 91204 -312 -KS -015)

Outlet Type Codes

KS=kitchen sink IF = indoor drinking fountain OT= other- please specify
CS = classroom sink OF= outdoor drinking fountain

Sample ID	Time	Sample Type (Initial or Flush)	Location Notes	Additional Observations	Water Cooler Manufacturer	Model Number	Serial Number

Appendix H: Sample Labels

Sample ID= School Entity ID-Room Number-Outlet Type-Sample Number (e.g. 91204-312-KS-015)

<u>Outlet Type Codes</u>

KS= kitchen sink IF= indoor drinking fountain

CS= classroom sink OF= outdoor drinking fountain

OT= other, please specify

Sample ID: ______________________
Sample Location: ______________________
Sample Type: ______________________
Date of Collection: ______________________
Time of Collection: ______________________
Sampler Initials: ______________________

Sample ID: ______________________
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Sampler Initials: ______________________________

Appendix I: Laboratory Chemistry Sample Submission Form

ADHS

BUREAU OF STATE LABORATORY SERVICES

250 N. 17th Avenue Phoenix, Arizona 85007
Chemistry Office: 602-542-6118 FAX: 602-364-0281
Victor Waddell, Ph.D., Bureau Chief

Public Health Chemistry Sample Submission Form

For Department Use Only

At a minimum the agency name, contact name, and phone number must be filled in below.
Enter sample information on the next page. Use multiple copies of page 2 if necessary.

Submitting Agency Information

Agency Name:			
Street Address:			
City:	**State:**	**Zip Code:**	**County:**
Contact Name:			**Phone:**
Sampler / Submitter:			

Sample Matrix:

☐ **Ground Water** ☐ **Paint Chip** ☐ **Soil/Solid** ☐ **Other (specify) _____**
☐ **Drinking Water** ☐ **Dust Wipe** ☐ **Unknown Substance**

Laboratory Testing Requested:

Refer to the Chemistry Guide to Laboratory Services for more information on specific testing. At least one test must be selected.

Inorganics – Waters Only

☐ Chloride
☐ Cyanide
☐ Fluoride
☐ Nitrite-nitrogen (NO_2-N)
☐ Nitrate-nitrogen (NO_3-N)
☐ Sulfate (SO_4)
☐ Turbidity
☐ pH, water

Metals – All Matrices

☐ Aluminum
☐ Antimony
☐ Arsenic
☐ Barium
☐ Beryllium
☐ Boron
☐ Cadmium
☐ Calcium
☐ Chromium
☐ Cobalt
☐ Copper
☐ Iron
☐ Lead
☐ Magnesium
☐ Manganese
☐ Mercury
☐ Molybdenum
☐ Nickel
☐ Potassium
☐ Selenium
☐ Silicon
☐ Silver
☐ Sodium
☐ Strontium
☐ Thallium
☐ Tin
☐ Titanium
☐ Uranium
☐ Vanadium
☐ Zinc

Organic Compounds

☐ Custom GC/MS Screen

Unknowns Analysis

☐ Determination of unknowns

Other Requests / Submitter Comments:

Comments: _____

_____

_____StarLIMS Folder #:_____

For Department Use Only

BUREAU OF STATE LABORATORY SERVICES
250 N. 17th Avenue Phoenix, Arizona 85007
Chemistry Office: 602-542-6118 FAX: 602-364-0281
Victor Waddell, Ph.D., Bureau Chief

Public Health Chemistry Sample Submission Form

For Department Use Only

All samples listed below will be analyzed per the laboratory test(s) requested on Page 1.
Samples need to be preserved as appropriate for the analytical method being requested.

Laboratory Sample Number	Sample Identification / Description	Date Sampled	Time Sampled	Number of Containers	Preservation (specify)
Temperature upon receipt: _____					

Chain of Custody Needed? ☐ Y or ☐ N
If yes, complete the lower section of document.

Comments for Laboratory use only:

_____
_____
_____
_____

CHAIN OF CUSTODY RECORD

Agency Name:	**_____For Sampler's Use Only_____**
Sampler's Signature:	Samples offered? ☐ **Y or** ☐ **N** Samples Refused? ☐
Print Name:	Samples offered to/refused by: Signature: _____ Title: _____ Date: _____

Relinquished by: (Signature)	(Print Name)	Received by: (Signature)	(Print Name)	Date / Time

Final disposal: Date disposed _____ Signature _____

Appendix J: EPA 200.8 BLS-282 Standard Operating Procedure

Procedure Name: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS)

1.0 Purpose

The purpose of this method is to determine the concentrations of trace metal elements in waters and wastes by inductively coupled plasma – mass spectrometry, as described in Environmental Protection Agency (EPA) method 200.8.

2.0 Scope

2.1 This method is for determination of dissolved elements in ground waters, surface waters, and drinking water. It may also be used for determination of total recoverable elements in these waters as well as wastewaters. Dissolved elements are determined after suitable filtration and acid preservation. Total dissolved solids in these samples should not exceed 0.2% (w/v) or 2000 mg/L. With the exception of silver, drinking water samples may be analyzed directly if the samples have been properly preserved with acid and have turbidity of <1 NTU. A digestion/extraction is required prior to analysis of total recoverable elements, as well as for silver.

2.2 Sample solution is introduced by pneumatic nebulization into a plasma where energy transfer processes cause desolvation, atomization, and ionization. The ions are extracted from the plasma through a differentially pumped vacuum interface and separated based on their mass-to-charge ratio by a mass spectrometer. The ions transmitted through the quadrupole are detected by an electron multiplier detector and the ion information is processed by a data handling system.

2.3 The following elements may be analyzed by this method. The asterisked elements are currently approved for analysis by Arizona State Public Health Laboratory (ASPHL).

Table 1: Analyte List for EPA Method 200.8 Analysis

Element	Symbol	Element	Symbol	Element	Symbol
Aluminum	Al	Antimony*	Sb	Arsenic*	As
Barium*	Ba	Beryllium*	Be	Cadmium*	Cd
Chromium*	Cr	Cobalt*	Co	Copper*	Cu
Lead*	Pb	Manganese	Mn	Mercury*	Hg
Molybdenum*	Mo	Nickel*	Ni	Selenium*	Se
Silver*	Ag	Thallium*	Tl	Thorium	Th
Uranium*	U	Vanadium*	V	Zinc*	Zn

2.4 This method may be performed on either the PerkinElmer DRC II ICP-MS or the Agilent 7700x ICP-MS.

3.0 Reagents/Standards/Media

3.1 Reagents

3.1.1 Reagent Water – American Society for Testing and Materials (ASTM) Type I water

3.1.2 Nitric Acid – Double distilled or Ultra Trace grade

3.1.3 Hydrochloric Acid – Double distilled or Ultra Trace grade S

3.1.4 Rinse solutions, 2% HNO_3 v/v – Add 40 mL HNO_3 to1 L reagent water and dilute to 2 L with reagent water. When carryover is evident, analyst may add 0.125% Triton-X to rinse solution (2.5 mL).

3.1.4.1 When analyzing mercury (Hg) on the DRC II, the addition of 100 µg/L of gold must be added to prevent carryover. The gold effectively rinses 5 µg/L mercury in approximately two minutes.

3.1.4.2 When analyzing mercury (Hg) on the Agilent, the gold is added concurrently with the internal standard solution. Refer to internal standard instructions for more information.

3.1.5 Tuning Solution – This solution is used for instrument tuning and mass calibration prior to analysis. The tuning solution can be purchased from a reputable commercial source.

3.1.5.1 PerkinElmer recommends the following solution for tuning and daily performance check: 10 µg/L of As, Be, and Se; 1.0 µg/L of Ba, Cd, Mg, In, Ce, Pb, Co, Cu, Li, Rh, Tl, and U in 0.5% nitric acid.

3.1.5.2 Agilent recommends the following solution for tuning: A 1.0 µg/L solution of Ce, Co, Li, Tl, and Y. This is prepared as follows: Place 0.05 mL of 10 mg/L Agilent 7500 series Tuning solution (or equivalent) into a 500 mL plastic Class A Flask, add 5.0 mL high purity nitric acid and dilute to volume.

3.1.5.3 Agilent also requires the use of a P/A solution to be used for the P/A adjustment (similar to the PerkinElmer instrument's dual detector calibration). Place 0.5 mL of PA tuning solution 1, 0.5 mL of PA tuning solution 2, and 0.5 mL nitric acid into a 50 mL plastic flask and dilute to volume.

3.2 Standards

3.2.1 Standard Stock Solutions – Use commercially prepared and NIST-certified stock solutions. These solutions are stable at least until the NIST expiration date. Solutions are purchased in either 100 mg/L or 1000 mg/L concentrations.

3.2.2 Multi-Element Intermediate Standards: Store intermediate stock standards in FEP bottles and replace them when succeeding dilutions for preparation

of the calibration standards cannot be verified with the quality control sample.

3.2.2.1 Intermediate A: Add 1 mL SPEX CAL STD 2 (100 mg/L of all Table 1 analytes except U and Hg) and 0.1 mL 1000 mg/L U to 100 mL Class A volumetric plastic flask, add 1 mL nitric acid, and bring to volume with reagent water.

3.2.2.2 Intermediate B: For mercury analysis, place 0.05 mL of 100 mg/L Hg into a 50 mL Class A volumetric plastic flask, add 0.5 mL of nitric acid and bring to 50 mL with deionized water. Final mercury concentration is 1 mg/L.

3.2.3 Multi-Element Working Standards

Working Standards are prepared as described below for analysis on either the PerkinElmer DRC-II (see Table 2) or the Agilent 7700x ICP-MS (see Table 3). Working standards should be prepared every two weeks or sooner. The volume prepared of the solutions may be adjusted to the amount required so long as the ratio of each component is kept constant. The volumes of the standards added to the mixes may be adjusted if a different concentration is purchased.

Table 2: Multi-element Working Standards (PerkinElmer DRC-II Analysis)

Standard	Volume of Intermediate	Final Volume in 1% HNO_3	Final Concentration – all analytes except Hg (µg/L)	Final Concentration – Hg only (µg/L)
1	A: 50 µL B: 25 µL	100 mL	0.50	0.25
2	A: 200 µL B: 50 µL	100 mL	2.0	0.5
3	A: 500 µL B: 100 µL	100 mL	5.0	1.0
4	A: 2 mL B: 200 µL	100 mL	20	2.0
5	A: 5 mL B: 300 µL	100 mL	50	3.0
6	A: 10 mL	100 mL	100	0

Table 3: Multi-Element Working Standards (Agilent 7700x Analysis)

Standard	Volume of Intermediate	Final Volume in 1% HNO_3	Final Concentration – all analytes except Hg (µg/L)	Final Concentration – Hg only (µg/L)
1	A: 50 µL B: 25 µL	100 mL	0.50	0.25
2	A: 100 µL B: 50 µL	100 mL	1.0	0.50
3	A: 1 mL B: 100 µL	100 mL	10	1.0
4	A: 2 mL B: 200 µL	100 mL	20	2.0
5	A: 5 mL B: 300 µL	100 mL	50	3.0
6	A: 10 mL	100 mL	100	0

3.2.4 Single Element Analysis

For any analysis where not all elements are required, the preparation may be changed for fewer elements (e.g. single element analysis). Preparation of the intermediate standard(s) and working standards should follow the instrument-specific instructions above for the analytes of interest.

3.2.5 Internal Standard Spiking Solution – Use commercially prepared and NIST-certified solutions of 10 mg/L Sc, Y, In, Tb, Bi, and Ge, or dilute 1.0 mL of each single-element stock standard (1000 mg/L) to 100 mL with reagent water containing 1% HNO_3 and store in a fluorinated ethylene propylene (FEP) bottle.

3.2.5.1 PerkinElmer DRC-II Analysis: Add 20 µL of internal standard (I.S.) spiking solution to each 10 mL aliquot of standard, blank, QC, and sample prior to analysis. The concentration of internal standards is 20 µg/L.

Note: If mercury is to be determined by the "direct analysis" procedure, add an aliquot of the gold stock standard to the internal standard solution sufficient to provide a final concentration of 100 µg/L in the final dilution of all blanks, calibration standards, and samples.

3.2.5.2 Agilent 7700x Analysis: For analysis performed on the Agilent 7700x instrument, the internal standard is added to all standards,

quality control and samples via the peristaltic pump and mixing coil, and not directly into the solutions. To prepare the internal standard solution, combine 3.2 mL of the 10 ppm Internal Standard Spiking Solution, 3.2 mL of a 10 ppm gold standard, and 1 mL concentrated nitric acid in a 100 mL volumetric plastic flask, and bring to volume with reagent water.

3.2.6 Blanks

3.2.6.1 Calibration Blank – Add 0.5 mL HNO_3 to 50 mL deionized water (DI) in a 100 mL flask. Bring to volume with DI, and add 0.5 mL HNO_3. Add internal standard as appropriate for the instrument prior to analysis (for filtered matrix).

3.2.6.2 Laboratory Reagent Blank (LRB) – Deionized water that must contain all the reagents in the same volumes as used in processing the samples. The LRB must be carried through the same sample preparation procedure including digestion and/or filtration. Add internal standards after preparation is complete.

3.2.6.3 Laboratory Fortified Blank (LFB) – To 50 mL of LRB, add 200 µL of Intermediate Standard A and 200 µL of Intermediate Standard B. Add internal standard (as appropriate for the instrument platform) after preparation is complete.

3.2.6.4 Rinse Blank – Consists of 2% HNO_3 (v/v) in reagent water.

3.2.7 Quality Control Sample (QCS)

3.2.7.1 QCS Stock Solution – Use a commercially prepared and NIST-certified solution from an alternate (secondary) source from the stock standards in 3.2.1. This solution is stable at least until the NIST expiration date.

3.2.7.2 Intermediate QCS Solutions – Store intermediate stock standards in FEP bottles and replace them when succeeding dilutions for preparation of the calibration standards cannot be verified with the quality control sample.

3.2.7.2.1 Intermediate A: Add 1 mL QCS Stock Solution (such as custom mix part # 4400-110329ES03 from CPI) to 100 mL Class A volumetric plastic flask, add 1 mL nitric acid, and bring to volume with reagent water.

3.2.7.2.2 Intermediate B: For mercury analysis, place 0.05 mL of 100 mg/L Hg (second source) into a 50 mL Class A volumetric plastic flask, add 0.5 mL of nitric acid and bring to 50 mL with deionized water. Final mercury concentration is 1 mg/L.

Table 4: QCS Preparation

Volume of Intermediate	Final Volume in 1% HNO_3	Final Concentration – all analytes except Hg (µg/L)	Final Concentration – Hg only (µg/L)
A: 2 mL B: 200 µL	100 mL	20	2.0

3.2.7.3 Prepare the working QCS solution as described in the table above. Working QCS should be prepared every two weeks or sooner. Internal standard is added as appropriate for the instrument platform prior to analysis.

4.0 Equipment/Instrumentation

4.1 Inductively coupled plasma mass spectrometer (ICP-MS), such as Perkin Elmer ELAN DRC-II or Agilent 7700x, capable of scanning the mass range of 5-250 amu with a minimum resolution capability of 1 amu peak width at 5% peak height.

Note: If an electron multiplier detector is being used, precautions should be taken to prevent exposure to high ion flux. Otherwise changes in instrument response or damage to the multiplier may result.

4.2 Autosampler (such as ISIS discrete sampling system for the Agilent 7700x, or AS-93 autosampler for the PerkinElmer DRC-II

4.3 Argon gas supply: High purity grade (99.99%).

4.4 Analytical balance capable of weighing to the nearest 0.1 mg.

4.5 A temperature adjustable block digester capable of maintaining a temperature of 95 °C ±5 °C.

4.6 Pipetters – All-plastic pneumatic variable-volume pipetters, capable of pipetting 40 – 1000 µL.

5.0 Supplies/Materials

5.1 Class A 50 mL digestion tubes – SCP Science or equivalent

5.2 Watch glasses for digestion tubes

5.3 Caps for digestion tubes

5.4 Glassware – Class A volumetric flasks. All glassware should be sufficiently cleaned by soaking overnight with laboratory-grade detergent or soaking for minimum of four hours in 20% (v/v) nitric acid, followed by rinsing with reagent water.

5.5 Teflon FEP or HDPE narrow-mouth storage bottles

5.6 One-piece stem FEP wash bottle with screw closure

5.7 50-mL and 15-mL sterile polypropylene centrifuge tubes

5.8 Pipette tips

5.9 0.45 µm pore diameter membrane filter

6.0 Specimen/Sample

6.1 This method may be used for the determination of dissolved elements in ground water, surface water, and drinking water; and total recoverable elements in ground water, surface water, drinking water, and wastewater.

6.2 For the determination of dissolved elements except Silver, the sample must be filtered through a 0.45 µm pore diameter membrane filter at the time of collection or as soon thereafter as practically possible. An exception to this requirement is drinking water samples collected from taps, fountains, etc. Use a portion of the sample to rinse the filter flask, discard this portion, and collect the required volume of filtrate. Acidify the filtrate with nitric acid immediately following filtration to pH <2.

6.3 For the determination of total recoverable elements in aqueous samples, samples are acidified with nitric acid to pH <2 without filtration.

6.4 Sample acidification, whether in the field or in the laboratory, is approximately a 0.5% acid preservation. For a 500 mL sample, add 2.5 mL of nitric acid. Adjust volume according to sample size to achieve the appropriate acidification level.

6.5 Following acidification in the field or in the laboratory, all samples should be mixed, held for 16 hours, and then verified to be pH <2 just before withdrawing aliquots for processing. If for some reason, such as high alkalinity, the sample pH is verified to be >2, more acid must be added and the sample held for 24 hours until verified to be pH <2. If properly acid-preserved, the sample can be held up to 6 months before analysis.

6.6 Refer to the Procedure section for sample preparation instructions.

7.0 Special Safety Precautions

7.1 SDSs for all the chemicals utilized in this procedure are available in the hard copy files. Staff performing this procedure is encouraged to familiarize themselves with the relevant information.

7.2 Standard safety precautions must be utilized at all times. Protect eyes and skin when preparing samples and standards or performing analyses. Each chemical should be regarded as a potential hazard, and exposure should be as low as reasonably achievable. Refer to the laboratory's Chemical Hygiene Plan and ADHS safety policies and procedures for details related to specific activities, reagents, or agents.

7.3 Analytical plasma sources emit radiofrequency radiation in addition to intense UV radiation. Suitable precautions should be taken to protect personnel from such hazards.

8.0 Disposal

Waste materials must be disposed of in compliance with laboratory, Federal, State, and Local regulations. Solvents and reagents should always be disposed of in an appropriate container clearly marked for waste products and temporarily stored in a chemical fume hood. Refer to SOP BLS-223, Waste Disposal, for additional information.

9.0 Quality Control

9.1 All reagents will be Ultra Trace grade.

9.2 Class A volumetric PFA plasticware and adjustable-volume pipettes will be used for standard and quality control sample preparation.

9.3 Ultrapure (18 MΩ-cm minimum) deionized water will be used for the preparation of blanks, standards, and reagents.

9.4 The laboratory is required to make an initial demonstration of laboratory capability (IDC) by determining the Linear Dynamic Range (LDR) and Method Detection Limit (MDL). The LDRs and MDLs should be determined whenever there is a change in instrument hardware or operating conditions. The MDLs should also be determined annually and when a new operator begins work. Refer to SOP BLS-235, Determination of Method Detection Limits and Initial Demonstration of Capability/Proficiency.

9.5 Quality Control Sample (QCS) – A QCS is analyzed at the beginning of each analysis. The determined concentration of the QCS must be within ±10% of the stated value. If the QCS is not within the required limits, an immediate second analysis of the QCS is recommended to confirm unacceptable performance. If the calibration standards cannot be verified, the source of the problem must be identified and corrected before continuing with the analysis.

9.6 Laboratory Reagent Blank (LRB) – At least one LRB must be analyzed with each batch of 20 or fewer samples. LRB data are used to assess contamination from the laboratory environment and to characterize spectral background from the reagents used in sample processing. LRB values must be less than 50% of the low standard levels. If LRB values are greater than the acceptance limits, fresh aliquots of the samples must be prepared and analyzed again for the affected analytes after the source of contamination has been corrected and acceptable LRB values have been obtained.

9.7 Laboratory Fortified Blank (LFB) – At least one LFB must be analyzed with each batch of 20 or fewer samples. If the recovery of any analyte falls outside the required control limits of 85-115%, that analyte is judged to be out of control, and the source of the problem should be identified and resolved before continuing with the analysis. LFB data must be kept on file and be available for review.

9.8 Instrument Performance Check (IPC) – For all determinations the laboratory must check instrument performance and verify that the instrument is properly calibrated on a continuing basis:

9.8.1 For continuing calibration check, analyze the calibration blank (ICB/CCB) and a mid-range calibration standard (ICV/CCV) after every 10 samples and at the end of analysis. The results of the first analysis of the Initial Calibration Blank (ICB) and Initial Calibration Verification (ICV) for all analytes must be within ±10% of the True Value (TV). The subsequent Continuing Calibration Blank (CCB) and Continuing Calibration Verification (CCV) must be within ±15% of the TV. If either continuing calibration check is not confirmed within the limits, the previous 10 samples are reanalyzed after recalibration. If the sample matrix is responsible for the calibration drift, it is recommended that the previous 10 samples are reanalyzed in groups of five between calibration checks.

9.9 Laboratory Fortified Matrix (LFM) – A minimum 10% of the samples analyzed must be spiked with a known amount of analyte. In each case, the LFM aliquot must be a duplicate of the aliquot used for sample analysis. The added analyte concentration must be the same as that in the LFB. The percent recovery in spiked samples must be between 70-130%. Recovery calculations are not required if the concentration of the analyte added is less than 30% of the sample background concentration. If recovery of any analyte falls outside the accepted range and laboratory performance for that analyte is shown to be in control, the recovery problem encountered with the LFM is judged to be matrix-related.

9.10 Internal standard responses – The responses from the internal standards should be monitored throughout the sample run. The absolute response of any one internal standard must not deviate more than 60-125% of the original response in the calibration blank. If any internal standard deviates outside of the acceptance limits the elements tied to that internal standard cannot be reported.

9.10.1 For analysis on the PerkinElmer DRC-II – Flush the instrument with the rinse blank and monitor the responses in the calibration blank. If the responses of the internal standards are now within the limits, take a fresh aliquot of the sample, dilute by a factor of two, add the internal standards, and reanalyze. If after flushing the responses of the internal standards in the calibration blank are out of limits, terminate the analysis and determine the cause of the drift. Possible causes of drift may be a partially blocked sampling cone or a change in the tuning condition of the instrument.

9.10.2 For analysis on the Agilent 7700x – as the internal standards are pumped in online, if the internal standard responses are outside the acceptance limits, the sample must be diluted and reanalyzed.

10.0 Procedure

10.1 Sample Preparation

10.1.1 Dissolved Analytes

10.1.1.1 For the determination of dissolved analytes in ground and surface waters, transfer a 50 mL aliquot of the filtered, acid-preserved

sample into a 50 mL polypropylene centrifuge tube. Add 250 µL of concentrated nitric acid to adjust the acid concentration of the aliquot to approximately a 1% nitric acid solution. Spike with 50 µL of 10 mg/L internal standard spiking solution.

Note: If a precipitate is formed during acidification, transport, or storage, the sample aliquot must be treated using the procedure in Section 10.1.2 prior to analysis.

10.1.1.2 Spike 10% of the total number of samples analyzed. The spike levels must be the same as used in the LFB.

10.1.1.3 Ten percent (10%) of the total number of samples to be analyzed will be prepared in duplicate.

10.1.2 Total Recoverable Analytes

10.1.2.1 For the "direct analysis" of total recoverable analytes in drinking water samples containing turbidity <1 NTU, treat an unfiltered acid-preserved sample aliquot using the sample preparation procedure described in Section 10.1.1.1.

10.1.2.2 For the determination of total recoverable analytes in ground and surface waters, or in drinking water samples containing turbidity >1 NTU, transfer a 50 mL aliquot from a well-mixed, acid preserved sample to a 50 mL digestion tube. Add 250 µL nitric acid and 250 µL hydrochloric acid.

Note: Instrument manufacturer states that higher acid levels will etch nebulizer spray chamber resulting in poor precision and accuracy.

10.1.2.3 Spike 10% of the total number of samples digested. The spike levels must be the same as that used in the LFB.

10.1.2.4 Ten percent (10%) of the total number of samples to be analyzed will be prepared in duplicate.

10.1.2.5 Place the digestion tubes in the block digester in a fume hood. Place a watch glass on each digestion tube, and reduce the volume of sample aliquot to about 10 mL by gentle heating at approximately 85 to 90 °C. Do not boil and do not allow temperature to go above 95 °C.

10.1.2.6 Remove samples from the digestion block and allow them to cool to room temperature. Dilute to 50 mL with reagent water. Add 50 µL of internal standard to each tube. Cap tube, and mix. Allow any particulate matter to settle overnight. If after settling overnight the sample contains suspended solids, a portion of the sample may be filtered prior to analysis.

10.2 Instrument Preparation – PerkinElmer DRC-II ICP-MS

10.2.1 Make sure that sample and drain tubes are clean and free from kinks. Remove any tubes that may be damaged or contaminated and install new tubes. Check waste and rinse water container levels. Also check the vacuum pump oil level and color.

10.2.2 Turn on the computer. Double-click the ELAN icon on the desktop. Open the **Instrument** window, and click the **Diagnostics** tab. Record the main water temperature, interface water temperature, and base vacuum pressure on the Daily Maintenance log sheet (FBLS-376).

10.2.3 Click the **Front Panel** tab. The status indicator should indicate **Ready** if all system hardware is operating properly. Click the **Plasma Start** button to start the plasma. DI water or rinse water should be aspirated at all times while the plasma is on. Make sure that solution is flowing into and out of the spray chamber. If not, adjust the clamp screws so that the solution can move smoothly. Allow a period of not less than 30 minutes for the instrument to warm up.

10.2.4 After instrument warm-up, perform a Daily Performance Check. Click the **Open Workspace** button and select Daily Performance.wrk. Also **Load** the appropriate Dataset. Place the sample capillary into the tuning solution. Click the **Sample** icon. Under the **Manual** tab, enter a sample description. Wait for the Daily Performance Check /Tuning solution to reach the nebulizer and click the **Analyze Sample** button. When completed, place the sample capillary into a wash solution. The Daily Performance Check must meet the following criteria before proceeding with the analysis:

Table 5: Performance Criteria for Elan DRC-II

Component	Acceptance Criteria
^{24}Mg Sensitivity	> 6,000 cps*
^{115}In Sensitivity	> 30,000 cps*
^{238}U Sensitivity	> 20,000 cps*
Precision %RSD	<3% per PerkinElmer
Ba^{2+}/Ba	< 0.033
CeO/Ce	< 0.033
Bkgd (Mass 220)	< 2 cps

*These are not absolute values. It is important to establish the typical numbers for the instrument.

10.2.5 Note: The DRC (dynamic reaction cell) is <u>not</u> approved for drinking water samples. The DRC <u>is</u> approved for As and Se in surface/ground water and wastewater samples. If necessary, perform a Daily Performance Check in DRC Mode for ^{75}As and ^{78}Se. Click the **Open Workspace** button and select DRC Check 2008.wrk. Load the appropriate Dataset. Place the sample capillary into the Daily

Performance Check / Tuning solution containing 10 µg/L As and Se. Select the **Sample** icon. Under the **Manual** tab, enter a sample description. After the appropriate delay, click the **Analyze Sample** button. Compare the ion intensity to previous DRC instrument performance to verify that the signal intensity is acceptable. The precision should be less than 3%. The Daily Performance tests in standard mode and DRC mode may be combined into one test by using Daily Performance+DRC.wrk and tuning solution spiked with As and Se. When completed, place the sample capillary into a wash solution.

10.2.6 If any of the Daily Performance values are not acceptable, some optimization may be necessary. Before performing optimization, however, be sure to check the cleanliness of cones, torch, injector, coil, and nebulizer/spray chamber. Clean or replace as necessary and perform the instrument optimization.

10.2.7 Perform Neb Flow optimization. Then rerun Daily Performance Check. If daily is in spec, proceed to Section 10.4 (Instrumental Analysis – PerkinElmer DRC-II). If daily is out of spec, follow the AutoLens and tune procedures described in 10.2.8 and 10.2.9.

10.2.8 AutoLens: To perform the AutoLens optimization, click **Open Workspace** and select autolens.wrk. Place probe in the Tuning solution, and wait 45 seconds for the solution to reach the spray chamber before clicking **Optimize**. After the AutoLens is complete, rerun daily. If the problem is not resolved, go to section 10.2.9.

10.2.9 Tune (mass calibration and peak resolution): Click the **Open Workspace** button and select Tuning Mass Spec.wrk. Place the sample capillary into the Tuning solution. Create a new dataset by clicking **R** on the side tool bar to view files currently in use and typing in the date of analysis as a dataset name.

10.2.9.1 In the **Tuning** window, make sure that the **Peak Width Only** parameter is toggled off, and click **Tune Mass Spec**. This will adjust the mass calibration. The measured masses should be ±0.1 amu of the actual masses. If the mass is not within ±0.1, open the **View Peak Window** and select a point that is closer to the target mass.

10.2.9.2 Once all the masses are adjusted, toggle on the **Peak Width Only** parameter, and click **Tune Mass Spec** again. This will adjust the resolution. The resolution should produce a peak width of 0.7 ±0.1 amu at 10% peak height. To decrease resolution, lower the DAC value. To increase resolution, increase the DAC value. A change in the DAC value of 30 units is an approximate 0.1 amu change in peak width.

10.2.9.3 Continue to adjust the DAC values and retune as necessary until the desired resolution is achieved. Save the default.tun file and print the Tuning Report.

10.2.10 After tuning, perform the AutoLens again. Save all files and rerun the daily. Place the sample capillary into a wash solution.

10.3 Instrument Preparation – Agilent 7700x ICP-MS

10.3.1 Make sure that sample and drain tubes are clean and free from kinks. Remove any tubes that may be damaged or contaminated and install new tubes. Check waste and rinse water container levels.

10.3.2 Double-click the Agilent icon (looks like a picture of the Agilent ICPMS) on the desktop.

10.3.3 Place the sample tube into DI water. Then click on the down arrow next to the plasma icon (top of screen). Select start plasma. A pop-up window will ask the user to confirm if the instrument performance checks are to be run. Click in the box and click OK. The instrument will run its programmed checks.

10.4 Instrumental Analysis – PerkinElmer DRC-II

10.4.1 Internal Standardization – Internal standards must be present in all samples, standards, and blanks at identical levels. Make sure that the selected internal standards are not present in samples. The internal standards should not interfere with the sample matrix nor with any analyte. The concentration of the internal standard should be sufficiently high that good precision is obtained in measurement and that errors caused by the naturally occurring internal standard in the sample are minimized.

PerkinElmer recommends keeping internal standards at a level that produces readings of 250,000 to 1,500,000 cps, which generally reflects a concentration of 10-20 µg/L. Prior to analysis, a 10 mL aliquot of each standard, blank, QC, and sample is spiked with 20 µL of internal standard spiking solution.

10.4.2 Calibration Curve – The instrument must be calibrated for the analytes to be determined using the calibration blank and calibration standards at one or more concentration levels. A minimum of three replicate integrations are required for data acquisition. Use Linear Through Zero calibration for PerkinElmer DRC-II analysis. The rinse blank should be used to flush the system between solution changes for blanks, standards, and samples.

10.4.3 Click the **Open Workspace** button to open the appropriate workspace for the method. Also **Load** the appropriate Dataset.

10.4.4 The analytical method has already been programmed and saved. Select "epa 200.8_expanded_list w hg.mth" for all analytes, or "pbonly.mth" for childcare lead analysis.

10.4.5 Create a new sample file or modify one used previously. Open the **Samples** window, and select the **Batch** tab. Type in the Sample ID and Autosampler (A/S) location for each sample. For spiked samples, change Sample Type from Sample to Spike, so the percent spike recovery will be calculated by the software. Make sure that the pump speed is consistent with that in the Method.

10.4.6 Place samples in the appropriate autosampler locations according to the sample file. On the Samples Batch page, highlight the table rows containing samples to be run, and click **Analyze Batch** to start the analysis.

10.4.7 To print each report as it is acquired, click the **Method** icon, and select the **Report** tab. Toggle on the **Send to Printer** option. A printed report for each standard, blank and sample will be generated.

10.4.8 At the end of the analysis, flush tubing with reagent water and pump it dry. Turn the plasma off immediately and exit the software. Release the pump tension on all tubing.

10.5 Instrumental Analysis – Agilent 7700x

10.5.1 Internal Standardization – Internal standards must be present in all samples, standards, and blanks at identical levels. Make sure that the selected internal standards are not present in samples. The internal standards should not interfere with the sample matrix nor with any analyte. The concentration of the internal standard should be sufficiently high that good precision is obtained in measurement and that errors caused by the naturally occurring internal standard in the sample are minimized.

Agilent has an in-built dilution factor of approximately 16 using the standard 0.25 mm ID tubing for the internal standard and 1.02 mm ID tubing for controls and samples. As described previously, the internal standard solution is added online via the peristaltic pump and mixing coil.

10.5.2 Calibration Curve – The instrument must be calibrated for the analytes to be determined using the calibration blank and calibration standards at one or more concentration levels. A minimum of three replicate integrations are required for data acquisition. Use Linear with Blank Offset for Agilent 7700x analysis. The rinse blank should be used to flush the system between solution changes for blanks, standards, and samples.

10.5.3 Click on the down arrow next to the batch icon (top of screen). The computer will list options. Choose "New Batch Folder". A screen will

pop up. In the New Batch name field, type in a batch name. In the Create From box click "Existing Batch". Click the select button and choose the file "EPA 200.8_Pb_only_template" for childcare lead analysis or choose "EPA 200.8_Biomon_ISIS_template.b" for the full EPA 200.8 analysis. Another pop-up will ask if all QC should be transferred. Click OK. Then click the create button.

10.5.4 The batch will open with the new batch name with all the QC elements and standards pre-loaded. Click on the sample tab. Choose unknown sample, then type in the sample ID numbers for each sample to be analyzed.

10.5.5 Click the tuning tab. Place the sample probe into the tuning solution and wait until the solution reaches the nebulizer. Tune inside the batch.

10.5.6 Click save batch.

10.5.7 Load the autosampler. Click "add to queue". The analysis will begin. A data analysis window will open and the results will be displayed as the samples are run.

10.5.8 As the sequence is running, examine the data for the ICS sample to confirm that the analyte concentrations are within the acceptable ranges. Data can be examined during analysis by using the "Offline Data Analysis" tool of the MassHunter software. At the completion of the sequence, examine the results to ensure that no memory effects or carryover have occurred.

10.5.9 At the end of the analysis, flush tubing with reagent water and pump it dry. Turn the plasma off immediately and exit the software. Release the pump tension on all tubing.

11.0 Interpretation/Results

11.1 Sample data is generated in units of µg/L. Final element concentrations are reported with two significant figures in units of mg/L.

11.2 Data values should be corrected for instrument drift or sample matrix interferences by the application of internal standardization. Corrections are applied to the data by the software.

11.3 Calculating Results:

For ICP-MS analyses, the software performs linear regression equations internally, producing concentration values as the output. It is not necessary to calculate the concentration values for samples that are below the instrument detection level (IDL). For analytes with concentrations above the IDL, multiply the concentration produced by the instrument by the dilution factor.

11.4 Data Review Process:

In order for results to be reported, they must first be peer reviewed by all necessary parties. Results produced are initially reviewed by a second analyst who is familiar with the method and qualified to perform data review. Data is then routed to the section supervisor and section manager for review and reporting to the submitter.

11.5 Percent recovery on spikes is calculated as follows:

$$\%\,R = \frac{A - B}{C} \times 100$$

where:

A = concentration of the spiked sample
B = concentration of the unspiked sample
C = true concentration of the spike

11.6 Calibration equations may be found in the Quality Assurance Plan and review of the instrument manufacturer's instructions/help. Correlation coefficient must be ≥ 0.998.

11.6.1 Perkin Elmer: Linear forced thru zero

11.6.2 Agilent: Linear with blank offset

$y = mx + b$

where:

m = slope
y = area response
x = concentration
b = 0

11.7 Ranges and Reporting Levels

Table 6: Ranges and Reporting Levels

Element	Mass	Calibration Range (µg/L)	Reporting Level (µg/L)
Antimony	121, 123*	0.5 – 100	2
Arsenic	75*	0.5 – 100	0.5
Barium	135, 137*	0.5 – 100	2
Beryllium	9*	0.5 – 100	0.5
Cadmium	111*, 114	0.5 – 100	0.5
Chromium	52*, 53	0.5 – 100	2
Cobalt	59*	0.5 – 100	2
Copper	63*, 65	0.5 – 100	2

Lead†	206*, 207*, 208*	0.5 – 100	2
Manganese	55*	0.5 – 100	2
Mercury	202*	0.25 – 3.0	0.5
Molybdenum	98*	0.5 – 100	2
Nickel	60	0.5 – 100	2
Selenium	82*	0.5 – 100	2
Silver‡	107*, 109	0.5 – 100	2
Thallium	203, 205*	0.5 – 100	0.5
Uranium	238*	0.5 – 100	2
Vanadium	51*	0.5 – 100	2
Zinc	66*	0.5 – 100	2

* Isotopes recommended for analytical determination.
† For childcare lead analysis the 0.5 µg/L standard is not needed and is not used.
‡ Silver is not analyzed on the Agilent 7700x.

12.0 Method Limitations

12.1 Isobaric elemental interferences are spectral interferences caused by isotopes of different elements having the same mass/charge ratio, which cannot be distinguished by the quadrupole. Of the analytical isotopes recommended for use with Method 200.8 (rev 5.4), only molybdenum-98 (ruthenium) and selenium-82 (krypton) have isobaric elemental interferences. Isobaric overlaps are corrected automatically by the ELAN software.

12.2 Wing overlap interferences may result when a small ion peak is being measured adjacent to a large one. The potential for these interferences should be recognized and the spectrometer resolution adjusted to minimize them.

12.3 Isobaric polyatomic ion interferences are caused by molecular ions having the same mass/charge ratio as the isotope of interest. These ions are commonly formed in the plasma or interface system from support gases or sample components. These interferences must be recognized and appropriate corrections made. Most polyatomic overlaps can be corrected by applying elemental equations, using alternative isotope masses, optimizing source and ion optic parameters, or using Dynamic Reaction Cell* (DRC).

*As of August 2017, the use of DRC technology was not yet approved by the U.S.EPA for drinking water samples.

12.4 Physical interferences may occur in the transfer of solution to the nebulizer (e.g., viscosity effects), at the point of aerosol formation and transport to the plasma (e.g., surface tension), or during excitation and ionization processed within the plasma itself. High levels of dissolved solids in the sample may contribute to deposits of material on the sampler and skimmer cones reducing the effective diameter of the orifices and ion transmission. Dissolved solids levels not exceeding 0.2% (w/v) have been recommended to reduce such effects. Internal standardization should be used to compensate for these physical interferences.

12.5 Memory interferences may result when isotopes of elements in a previous sample contribute to the signals measured in a new sample. Memory effects can result from sample deposition on the sampler and skimmer cones and from the buildup of sample material in the plasma torch and spray chamber. These effects can be minimized by flushing the system with a rinse blank between samples. The rinse times should be estimated based on the length of time required to reduce analyte signals to within a factor of 10 of the method detection limit after aspirating a standard containing elements corresponding to 10 times the upper end of the linear range. Memory interferences may also be assessed within an analytical run based on the consistency of integrated signal values among three replicates. If the signal values drop consecutively, the analyst should examine the analyte concentration in the previous sample to identify if this was high. If memory interference is suspected, the sample should be reanalyzed after a long rinse period.

13.0 References

13.1 Method 200.8 revision 5.4: Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma – Mass Spectrometry. U.S. EPA, Office of Research and Development, Cincinnati, Ohio, 1994.

13.2 EPA Manual for the Certification of Laboratories Analyzing Drinking Water, Fifth Edition, January 2005.

14.0 Definitions

Not applicable.

15.0 Related Documents

15.1 ELAN Version 3.0 Software Guide

15.2 Inductively Coupled Plasma Mass Spectrometry with ELAN Software Customer Training, Rev. B

15.3 Agilent 7700 Series ICPMS MassHunter Workstation User Guide. Rev. A, May 2012.

15.4 BLS-121, Preservation and Preparation for Total Recoverable Metals

15.5 BLS-223, Waste Disposal

15.6 BLS-235, Determination of Method Detection Limits and Initial Demonstration of Capability/Proficiency

15.7 FBLS-019, Digestion Sheet

15.8 FBLS-376, DRC II LC-ICP-MS Maintenance Checklist

16.0 Appendices

16.1 Appendix A – ELAN Instrument Parameters Optimization Sequence

16.2 Appendix B – Recommended Elemental Equations for Data Calculations

16.3 Appendix C – Agilent 7700x Instrument Settings

Version Tracking

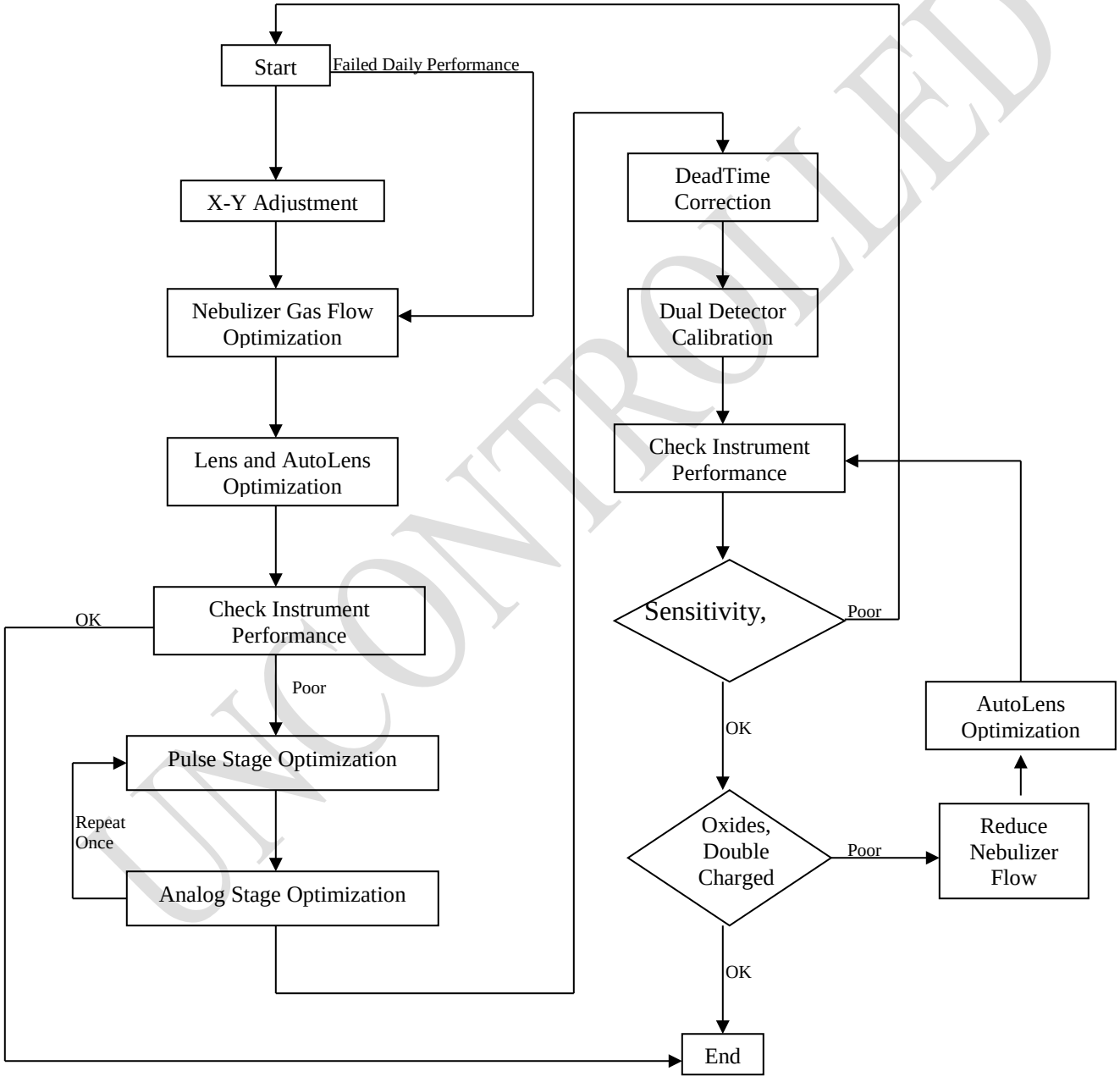
Version #	Changes Made	Date Approved	Author(s) (optional)
00	New SOP	5/14/2008	David Ouellette
01	Revised	9/15/2009	David Ouellette
01	Reformatted	2/25/2016	Daniel N. Perez
02	Added mercury analysis instructions; added language for Agilent 7700x instrument usage; added clarification language that drinking water samples do not need to be filtered prior to analysis; major wordsmithing; updated standards prep information.		

Appendix A

ELAN Instrument Parameters Optimization Sequence

ELAN Instrument Parameters Optimization Sequence

The instrument must run for at least 30 minutes with the plasma on before performing the optimization. Perform the optimization if the Daily Performance test does not pass or after cleaning or replacing the components of the sample introduction system, torch, or cones. Step-by-step instructions of each optimization process are found in the ELAN Software Guide.



Appendix B

Recommended Elemental Equations for Data Calculations

Recommended Elemental Equations for Data Calculations

Table 7: PerkinElmer Elemental Equations

Element	Elemental Equation	Note
Be^{9}	(1.000) (C)	
Sc^{45}	(1.000) (C) – (0.0115*Si^{29})	(1)
Cr^{52}	(1.000) (C)	
Cr^{53}	(1.000) (C) – (0.00097*Cl^{37})	(2)
Cu^{63}	(1.000) (C)	
Cu^{65}	(1.000) (C)	
As^{75}	(1.000) (C) – 3.127*[Se^{77} – (0.874*Se^{82})]	(3)
Se^{77}	(1.000) (C) – (0.0000515*Cl^{37})	(4)
Se^{82}	(1.000) (C) – (1.007833*Kr^{83})	(5)
Ag^{107}	(1.000) (C)	
Ag^{109}	(1.000) (C)	
Cd^{106}	(1.000) (C)	
Cd^{108}	(1.000) (C)	
Cd^{111}	(1.000) (C)	
Cd^{114}	(1.000) (C) – (0.027250*Sn^{118})	(6)
In^{115}	(1.000) (C) – (0.014038*Sn^{118})	(6)
Sb^{121}	(1.000) (C)	
Sb^{123}	(1.000) (C) – (0.125884*Te^{125})	(7)
Ba^{135}	(1.000) (C) – (0.000901*La^{139}) – (0.002838*Ce^{140})	(7)
Tl^{203}	(1.000) (C)	
Tl^{205}	(1.000) (C)	
Pb^{208}	(1.000) (C) + (1.0*Pb^{206}) + (1.0 *Pb^{207})	
Bi^{209}	(1.000) (C)	

(C) – Calibration blank subtracted counts at specified mass.

(1) – To correct for additive interference of SiO.

(2) – Correction for chloride interference with adjustment for Cr^{53}. ClO 51/53 ratio may be determined from the reagent blank. Isobaric mass 52 must be from Cr only not ArC^{+}.

(3) – Correction for chloride interference with adjustment for Se^{77}. ArCl 75/77 ratio may be determined from the reagent blank. Isobaric mass 82 must be from Se only and not BrH^{+}.

(4) – To correct for Cl.

(5) – Some argon supplies contain krypton as an impurity. Selenium is corrected for Kr^{82} by background subtraction.

(6) – Isobaric elemental correction for tin.

(7) – Automatically input from Instrument vendor software.

Appendix C

Agilent 7700x Instrument Settings

Agilent 7700x Instrument Settings

Table 8: Typical settings for the Agilent 7500 ICP-MS

Parameter	Setting*
RF power (W)	1550
Carrier gas flow (L/min)	1.0-1.1
Make-up gas flow (L/min)	0
Spray chamber temp (°C)	2
Acquisition Mode:	
Spectrum Analysis (Multi Tune)	
Reaction gas (He or H_2) flow rate (mL/min)	2-6
Tune step 1	Std mode
Tune step 2	He mode
Stabilization time tune 1 (sec)	30
Stabilization time tune 2 (sec)	30
Data Acquisition:	
Detector mode	Auto
Points/mass	3
Integration time/point tune 1 (sec)	0.3
Integration time/point tune 2 (sec)	0.3
Replicates	3
Before Acquisition:	
Uptake speed (rps)	0.3
Uptake time (sec)	55
Stabilization time (sec)	30
During Acquisition:	
Uptake Speed (rps)	0.1
After Acquisition (Probe Rinse):	
Rinse speed (rps)	0.3
Rinse time (sec)	15
After Acquisition (Rinse)	
Rinse speed (rps)	0.3
Vial Rinse time (sec)	90

* Settings may vary

Note: The Agilent 7700x automatically brings up Standard tune and He tune based on the template used for analysis.